INSTRUCTION MANUAL FOR MODEL 117A

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INSTRUCTION MANUAL

FOR

NOISE FIGURE METER

model 117A

MAGNETIC AB
Stockholm - Sweden

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1. INTRODUCTION

1.1 General description

Precision Noise Figure Meter model 117A with an appropriate noise source, automatically and continuously displays the noise figure of the receiver to which it is attached. The noise figure of a receiver is a measure of its sensitivity; the lower the noise figure the better the sensitivity.

Model 117A is designed for receivers having intermediate frequencies between 5-500 MHz (Different Amplifiers required). It may also be used with devices tuned to other frequencies if a converter is used to obtain the frequencies mentioned above.

The noise figure meter provides a convenient and simple method of measuring and optimizing the noise figure of a receiver or amplifier.

1.2 Noise Sources

MAGNETIC AB manufactures three types of noise sources, which can be used with Noise Figure Meter model 117A. The noise figure meter can supply these sources with suitable voltages and currents.

1.2.1 Noise Source Model 121 (Requires Modulator model 1175)

Each noise source consists of a length of waveguide in which is mounted a gas-discharge noise tube. Accurate measurements are assured, since careful design has made the VSWR low. These sources are available in S, G, J, H, X, P and K-bands or 2.6 to 26.7 GHz.

1.2.2 Noise Source Model 122C (Requires Modulator model 1175)

This noise source consists of a helical transmission line with a gas discharge tube mounted inside. The impedance is 50 ohm and it can be used in the frequency range 250 to 4000 MHz.

1.2.3 Noise Source Model 123 (Requires Modulator model 1177)

This noise source uses a temperature-limited diode as noise generator. The generator impedance is 50 ohm and it can be used in the frequency range 5 to 250 MHz. This source is also available with higher impedances.

1.2.4 Solid State Noise Source (Requires Modulator model 1179)

This noise source uses a solid state diode as noise generator. The generator impedance is 50 ohm and it is available in the frequency range 5 MHz to 18 GHz.

1.3 Specifications

NOISE FIGURE METER Model 117A

FREQUENCY RANGE:	Depends on noise source used (5 MHz to 40 GHz available)
NOISE FIGURE RANGE:	0-30 dB in 5 ranges (indication to infinity)
ACCURACY (with Plug-in 1171):	± 0.15 dB x), 0-9 dB ± 0.25 dB x), 9-18 dB ± 0.5 dB x), 18-25 dB ± 1.0 dB x), 25-30 dB

x)
For the temperature range 15-30°C and input signal levels of 100 uV - 10 mV this accuracy increases to:

± 0.1, 0-9 dB
± 0.2, 9-18 dB
± 0.4, 18-25 dB

EXCESS NOISE COMPENSATOR:	Range 14.5-16.5 dB
INPUT FREQUENCY:	See Plug-in specification
INPUT VOLTAGE:	See Plug-in specification
INPUT IMPEDANCE:	50 ohms, nominal
BANDWIDTH:	See Plug-in specification
OUTPUTS:	
RECORDER:	0-4 V, Ri ≈ 2 kohm
NOISE SOURCE:	Will operate Gas Discharge Tub Thermionic Diode and Solid State Noise Sources
VIDEO:	110 mV (small pulse)
POWER INPUT:	115/220/230 V ± 10% 50-400 Hz, 30 W
TEMPERATURE RANGE:	Operating 0 to +55°C Storage -40 to +75°C
DIMENSIONS:	420 x 180 x 305 mm (W x H x D) Mounting brackets for 19" rack available
WEIGHT:	12 kg

2. OPERATING INSTRUCTIONS

2.1 Introduction

This section tells how to perform noise figure measurements on receivers and amplifiers.

2.2 Controls and Connectors on the Panel

2.2.1 Meter Function Switch

This is a push button control with eight push buttons, one for each range. These are: 0-15 dB, 3-18 dB, 6-21 dB, 9,24 dB, 15-30 dB, SET ∞, CURRENT 4 mA and CURRENT 12 mA. Position SET ∞ (with its screwdriver control) is used to calibrate the meter before measurement. 0-15, 3-18, 6-21, 9-24 and 15-30 dB are used when the noise figure is to be read on the meter. A range can almost always be chosen so that the meter can be operated in the upper half of the scale deflection. Positions CURRENT 4mA and CURRENT 12 mA are used for setting up the noise sources.

2.2.2 Noise Source

This is a push button control consisting of four buttons. One for SOLID STATE on, one for GAS TUBE on, one for OFF and one for DIODE on.

2.2.3 Current

The noise figure meter has two current controls. One for noise sources with gas-discharge tubes called CURRENT x 100 and one for diode noise sources labelled CURRENT x 1.

2.2.4 Excess Noise Compensator

This digital switch is used to set the excess noise of the noise source being used (gas discharge tube-and solid state noise source only). The scale of the noise figure meter then reads noise figure without any mental corrections. A light to the left of the digital switch warns the operator if he has adjusted it outside its range.

2.2.5 Input

Connect to output of equipment being measured. Switch above INPUT connector is an input attenuator to aid the AGC system in the noise figure meter. Depending on the level of the input signal, the suitable range should be chosen. The AGC system operates over the full range but the attenuator is used to reach the ultimate in accuracy.

A light to the right of the plug-in unit warns the operator when the signal is too low.

2.3 Controls and Connectors on the back

All other connectors have, for the convenience of the operator, been placed at the back of the instrument.

2.3.1 PRF Control

This control adjusts the PRF of the master multivibrator. Set the control to any convenient position to eliminate beat effects in the over-all system; such as power line harmonics. Such effects are usually noticable as wide excursions of the meter pointer. This control does not in any way effect the basic accuracy of the 117A.

2.3.2 Manual Gain Control

This control adjusts the gain of the amplifier, when the noise figure meter is used for manual measurements or as an indicator. The range of this control is approximately 60 dB.

2.3.3 Auto-Manual Switch

This switch is used to select the automatic or manual mode of operation.

2.3.4 Gas Tube connector (Modulator model 1175)

A noise source with a gas-discharge tube shall be connected to this connector. NOTE - this is a MHV connector and not a BNC. If the GAS TUBE push button is pushed, with no source connected, a high voltage spike will be developed across the connector. This will not damage the equipment, but can be dangerous to the operator if he is trying to touch the center conductor.

2.3.5 6.3 V 0.8 A (Modulator model 1175)

Heater voltage for noise sources requiring a heater supply. The heater supply is floating. Ground return is available on one of the pins in the connector.

2.3.6 Diode connector (Modulator model 1177)

Thermionic-Diode Noise Sources shall be connected to this connector, which is a MS-3102A-14s-5s connector.

2.3.7 Solid State Noise Source connector (Modulator model 1179)

Solid state noise sources shall be connected to this connector, which is a BNC connector.

2.3.8 Video

The video signal in the instrument is available for observations in this connector. During measurement of noise figure this signal is a wave form where every second pulse is lower in amplitude than the rest.

When the noise figure is infinite the amplitudes are equal. There should be a smooth noise on the tops of the pulses. Any interference signals in the system will show up here. The smaller pulses have an amplitude of about 110 mV.

2.3.9 Recorder (Remote meter)

A DC voltage proportional to the panel meter deflection is available for recorder or remote meter operation. Full scale is approximately 4 V (R_i = 2 kohm).

2.3.10 MVB

Wave form for driving a maintenance calibrator unit is available from this connector.

2.4 Automatic Operation

2.4.1 Automatic Measurement of Noise Figure Using a Gas Discharge Noise Generator

1. Connect equipment as shown in fig. 2.1 and connect to the receiver, where the signal level is within the range for the "Amplifier". Select the correct input frequency or if necessary change plug-in amplifier.

2. Set the input attenuator to the upper range, if the light "INPUT LOW, is on, switch the attenuator to the lower range. This procedure is the simplest way to choose the suitable range for best accuracy.

3. Connect source to GAS TUBE connector (Modulator 1175).

4. Set meter function switch to "Current 4 mA".

5. Push button "GAS TUBE" on NOISE SOURCE switch.

6. Adjust current to the following value: (or the value shown in the noise source instruction book):

Model	Current
S121	200 mA
G, J, H, X, P and K121	175 mA
122A	100 mA
122C	175 mA

7. Set "EXCESS NOISE" switch to excess noise for the noise source in use (see noise source instruction book).

8. Push button "SET ∞" and set meter to ∞ (infinity).

9. Set meter function switch to any of the NOISE FIGURE ranges and read noise figure.

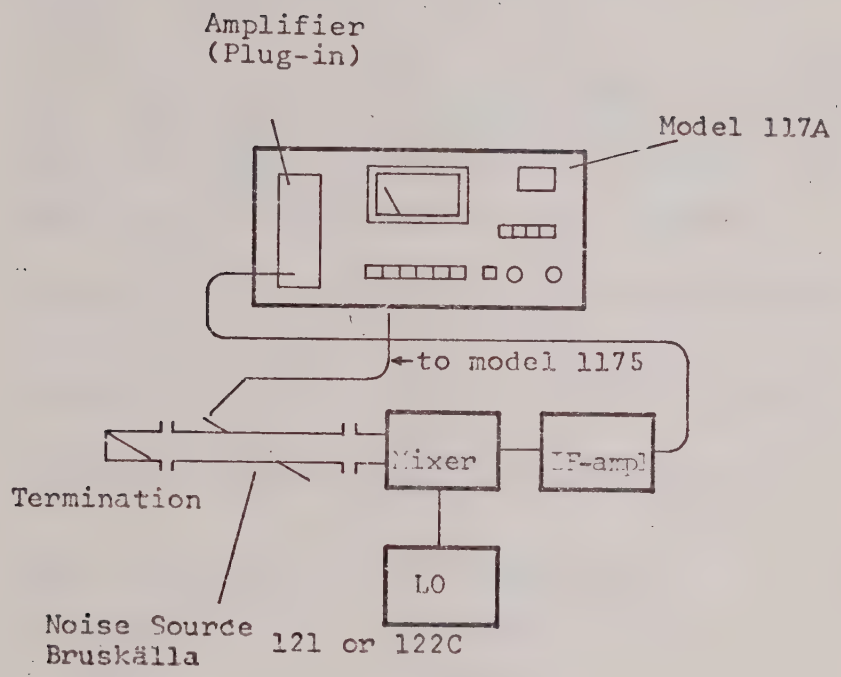


Fig. 2.1

Set up for Automatic Measurement using a Gas Discharge Noise Source.

Mätuppkoppling för automatisk mätning av brusfaktor. Brusgenerator med gasurladdningsrör.

2.4.2 Automatic Measurement of Noise Figure Using a Thermionic-Diode Noise Generator

1. Connect equipment as shown in fig. 2.2 and connect to the receiver where the level is within the range for the "Amplifier". Select the correct input or if necessary change plug-in amplifier.

2. Set the input attenuator to the upper range, if the light "INPUT LOW" is on, switch the attenuator to the lower range. This procedure is the simplest way to choose the suitable range for best accuracy.

3. Connect noise source to DIODE connector (Modulator 1177).

4. Set meter function switch to appropriate current scale.

5. Push button "DIODE" on "NOISE SOURCE" switch.

6. Adjust current to the following value:

Model	Current
123A	7.08 mA

or

$$I = \frac{50 \times 7.08}{R}$$

where R = source impedance

7. Push button "SET ∞" and set meter to ∞ (infinity).

8. Set meter function switch to any of the NOISE FIGURE ranges, except the 15-30 dB range, and read noise figure.

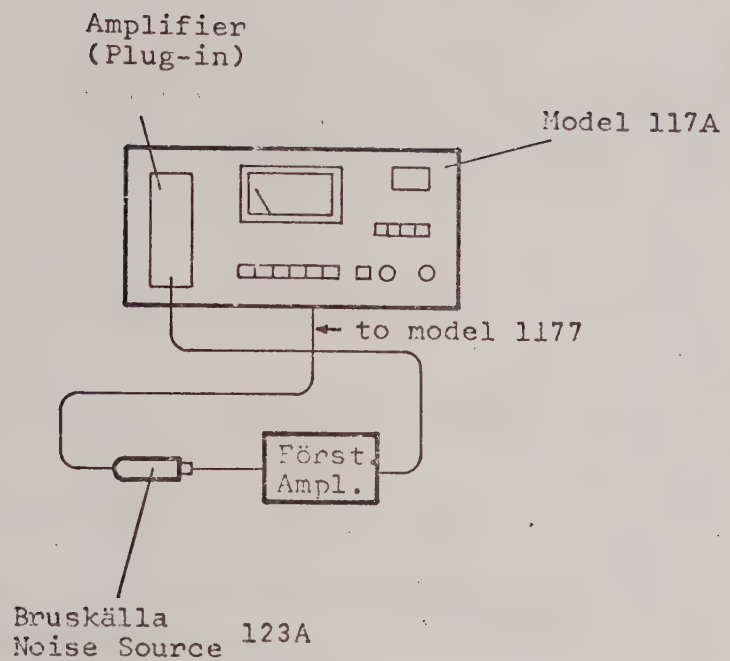


Fig. 2.2

Set up for Automatic Measurement using a Temperature Limited Diode Noise Source.

Mätuppkoppling för automatisk mätning av brusfaktor. Brusgenerator med temperaturbegränsad diod.

2.4.3 Automatic Measurement of Noise Figure Using a Solid State Noise Source

1. Connect equipment as shown in fig. 2.3 and connect to the receiver where the signal level is within the range for the "Amplifier". Select the correct input frequency or if necessary change "Amplifier".

2. Set the input attenuator to the upper range, if the light "INPUT LOW" is on, switch the attenuator to the lower range. This procedure is the simplest way to choose the suitable range for best accuracy.

3. Connect source to 'SOLID STATE connector. (Modulator 1179).

4. Set meter function switch to "CURRENT 4 mA".

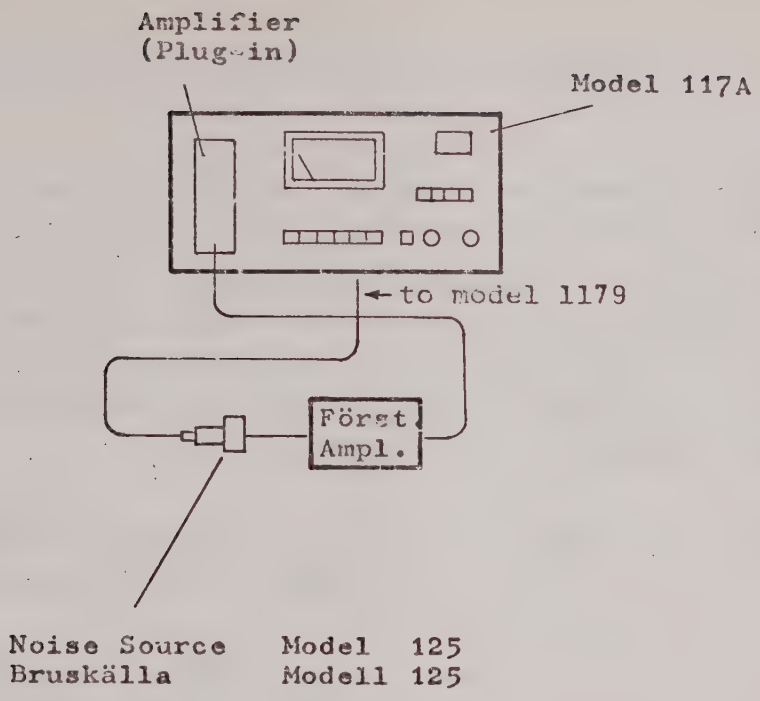
5. Push button "SOLID STATE" on NOISE SOURCE switch.

6. Indicate 5-10% deflection on panel meter. (No current adjust).

7. Set "EXCESS NOISE" switch to excess noise for the noise source in use (See Manual for model 125).

8. Push button "SET ∞" and set meter to ∞ (infinity).

9. Set meter function switch to any of the NOISE FIGURE ranges and read noise figure.



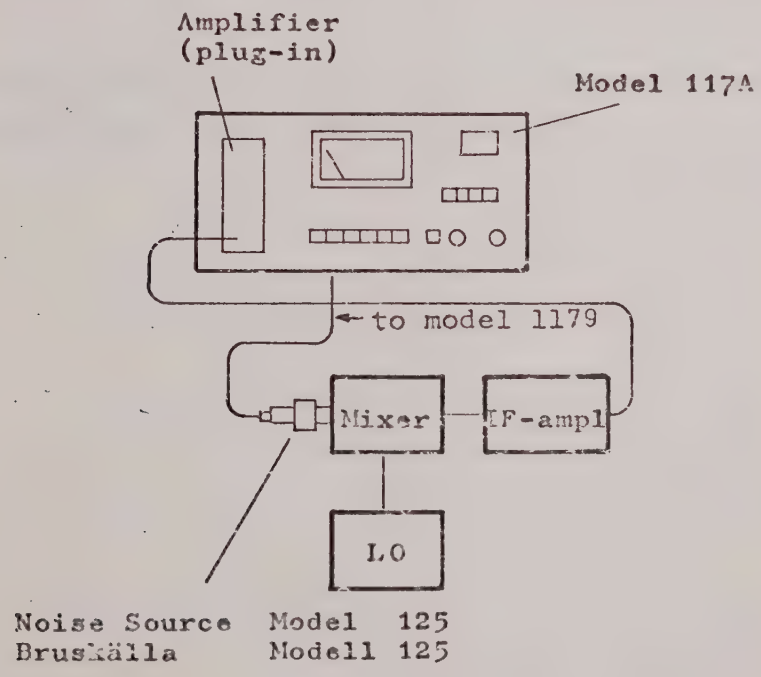


Fig. 2.3

Set ups for Automatic Measurement using a Solid State Noise Source.

Mätuppkopplingar för automatisk mätning av brusfaktor. Brusgenerator med halvledarbruskälla.

2.4.4 Recorder (External indicator) Scale Calibration

Calibration is very simple to perform. The infinity (∞) point is set using normal calibration procedure. The full scale deflection (0 dB) is set by switching the AUTO-MAN switch to MAN and connecting a signal to the AMPLIFIER input. The full scale deflection is now set by the MANUAL GAIN control at any noise figure range. This gives the two calibration points, infinity and full scale deflection (0, 3, 6, 9 and 15 dB), for an external indicator.

The following equation is used to calibrate the recorder or an external meter scale.

$$\text{Deflection} = \frac{100}{\text{Antilog } \frac{F-A}{10}} \text{ per cent}$$

where A is equal to 0, 3, 6, 9 or 15 dB depending on range used and F is noise figure in dB.

2.5 Manual Operation

2.5.1 Manual Measurement of Noise Figure Using a Gas Discharge Noise Generator

1. Connect Noise Figure Meter as shown in fig 2.4.

2. Adjust noise source current and EXCESS NOISE as under Automatic Measurement.

3. Set the AUTO MANUAL Switch to"MANUAL".

4. Set NOISE SOURCE to"OFF".

5. Set METER FUNCTION Switch to any convenient Noise Figure Range.

6. Adjust the MANUAL GAIN Control for a mid scale deflection (3 dB).

7. Push button "GAS TUBE" on the NOISE SOURCE switch.

8. Adjust attenuator at the output of the noise source till the meter reads full scale (0 dB).

9. Noise Figure is now EXCESS NOISE minus reading of attenuator (in dB).

The measurement can also be done as follows:

2.5.1, 1-5 and then:

6a. Adjust the MANUAL GAIN on the noise figure meter for a convenient reading on the meter scale.

7a. Push button "GAS TUBE" on NOISE SOURCE switch.

8a. Switch in the 3 dB attenuator at the input of the noise figure meter.

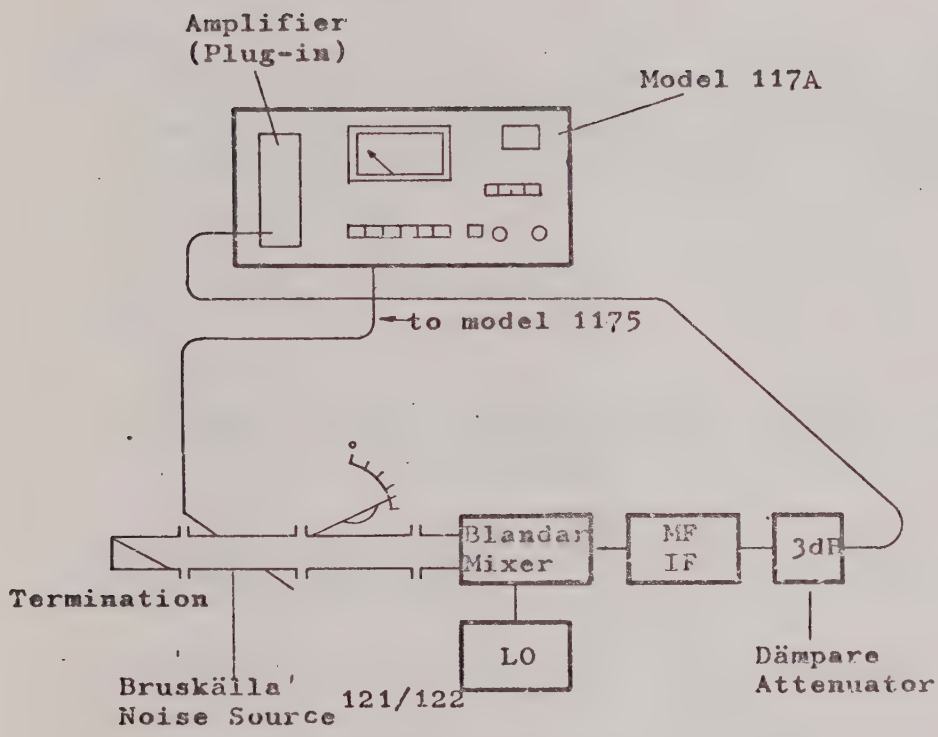


Fig. 2.4

Set up for manual Measurement using a Gas Discharge Noise Source.

Mätuppkoppling för manuell mätning av brusfaktor. Brusgenerator med gasurladdningsrör.

9a. Adjust the attenuator at the output of the noise source till the meter reads the same as under 6a.

10a. Noise Figure is now EXCESS NOISE minus reading of attenuator (in dB).

Note:

For receivers having noise figures higher than the excess noise of the noise source the ratio will be lower than 3 dB. In this case the noise figure can be computed from:

$$F = ENR_{dB} - 10 \log \left(\frac{I \text{ max}}{I \text{ min}} - 1\right) \qquad (2.1)$$

where

I max is meter reading with noise source on and
I min is meter reading with noise source off.

2.5.2 Manual Measurement of Noise Figure Using a Thermionic Diode Noise Generator

1. Connect Noise Figure Meter as shown in fig 2.5.

2. Set the AUTO-MANUAL Switch to"MANUAL"

3. Set NOISE SOURCE to"DIODE"and CURRENT x 1 to minimum (CCW).

4. Set METER FUNCTION Switch to"SET cc"

5. Adjust the MANUAL GAIN Control for a reading on the upper part of the meter scale, e.g. 0.5 dB.

66. Push the button"ADD 6dB" on the METER FUNCTION Switch.

7. Adjust CURRENT x 1 for the same reading as in 5. above.

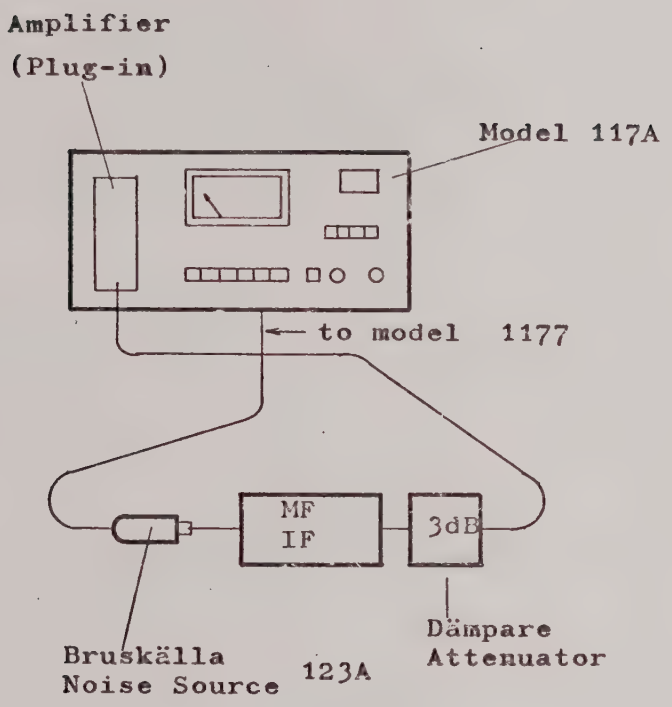


Fig. 2.5

Set up for manual Measurement using a Temperature Limited Diode noise source.

Mätuppkoppling för manuell mätning av brusfaktor. Brusgenerator med temperaturbegränsande diod.

8. Push the METER FUNCTION switch to "CURRENT 12 mA" or "CURRENT 4 mA" and read the noise diode current.

9. Noise Figure is now:
   $F = 10 \log 20 IR$ (2.2)
   where
   I = diode current (amp)
   R = diode source impedance (ohms)

As under 2.5.2, Manual Measurement with a Gas Tube Source a 3 dB attenuator can be used instead of doubling the meter reading.

2.5.3 Manual Measurement of Noise Figure Using a Solid State Noise Generator

1. Connect Noise Figure Meter as shown in fig. 2.6

2. Check noise source current and adjust EXCESS NOISE as under Automatic Measurement.

3. Set the AUTO MANUAL switch to "MANUAL".

4. Set NOISE SOURCE to "OFF".

5. Set METER FUNCTION switch to any convenient Noise Figure Range.

6. Adjust the MANUAL GAIN Control for a mid scale deflection (3 dB).

7. Push button "SOLID STATE" on the NOISE SOURCE switch.

8. Adjust attenuator at the output of the noise source till the meter reads full scale (0 dB).

9. Noise Figure is now EXCESS NOISE minus reading of attenuator (in dB).

The measurement can also be done as follows:

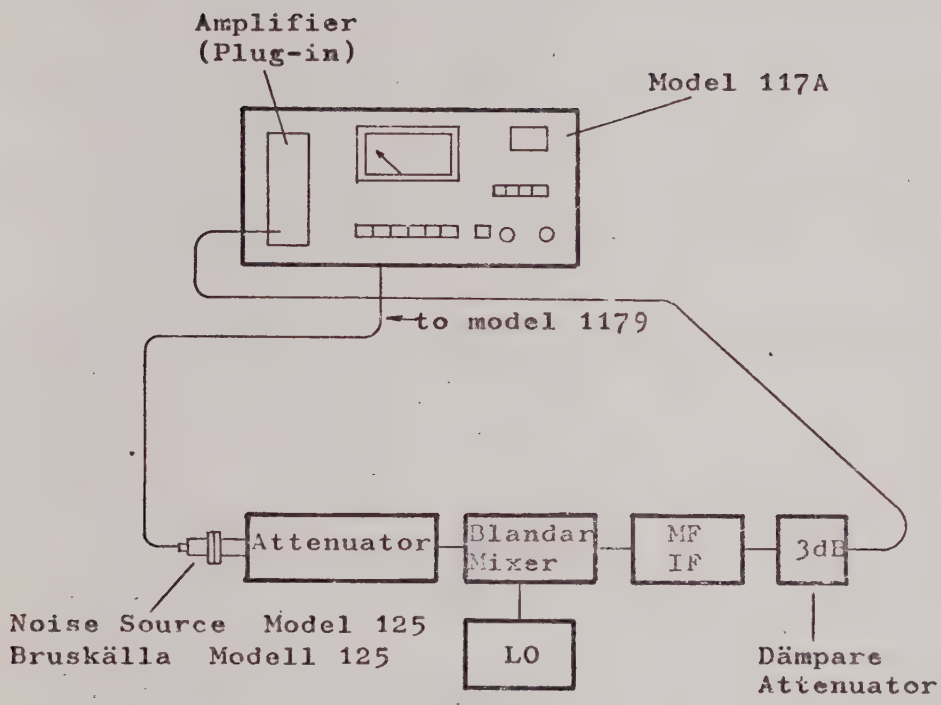


Fig. 2.6

Set up for manual Measurement using a Solid State Noise Source.

Mätuppkoppling för manuell mätning av brusfaktor. Brusgenerator med halvledarbruskälla.

2.5.1, 1-5 and then:

6a. Adjust the MANUAL GAIN on the noise figure meter for a convenient reading on the meter scale.

7a. Push buttom "SOLID STATE" on NOISE SOURCE switch.

8a. Switch in the 3 dB attenuator at the input of the noise figure meter.

9a. Adjust the attenuator at the output of the noise source till the meter reads the same as under 6a.

10a. Noise Figure is now EXCESS NOISE minus reading of attenuator (in dB).

Note:

For receivers having noise figures higher than the excess noise of the noise source the ratio will be lower than 3 dB. In this case the noise figure can be computed from:

$$F = ENR_{dB} - 10 \log \left(\frac{I \text{ max}}{I \text{ min}} - 1\right) \qquad (2.1)$$

where
I max is meter reading with noise source on and
I min is meter reading with noise source off.

2.5.4 Precautions when Measuring Noise Figure Manually.

Due to the high accuracy of noise figure meter model 117A very high accurate attenuators are required when manual measurements are made. The error of the attenuator at the output of the noise source enters directly into the noise figure value. If a 3 dB attenuator is used to establish the ratio at the output of the measured device, its error enters twice onto the equation for noise figure. This means that one would have to use attenuators, which are much better than ± 0.1 dB. Typically one would have ± 0.2 dB for the attenuator at the noise source output and ± 0,5 dB for the 3 dB attenuator. This results in an error of ± 0.3 dB in noise figure.

2.6 Sources of Error

In some cases it may be necessary to know the absolute values of noise figure. If this is the case, then consideration must be given to sources of error in the measurement.

The noise figure is a relative measurement based on power available from a termination (generator impedance) at a temperature of 290°K. Several factors can cause a difference between measured and actual noise figure. Most important of these factors are:

1. Coupling and transmission line errors.
2. Ambient or termination temperature different from 290°K.
3. Receiver mismatch.
4. Noise source mismatch.

The first of these sources of error is a function of the coupling of the noise generating tube to the transmission line, and the attenuation of the transmission line. These can be estimated by measuring the attenuation through the noise source with the noise tube on (hot loss) and with it off (cold loss). See fig 2.7. Noise sources for Model 117A need no correction as this error is less than 0.15 dB.

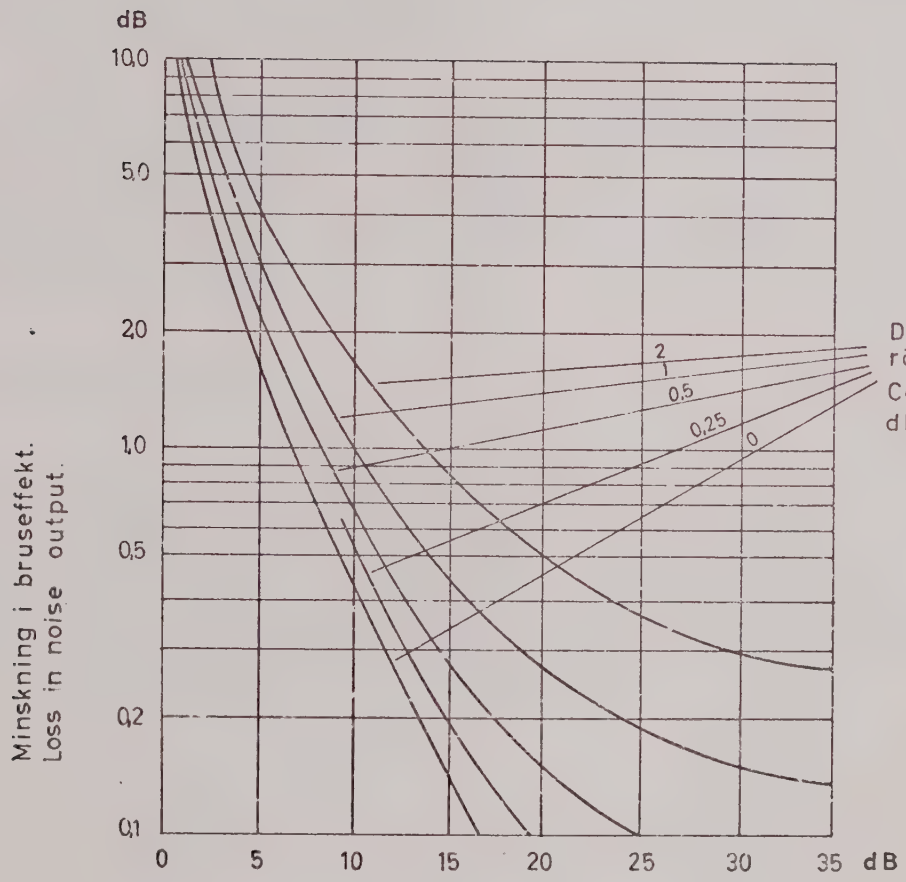
The second source of error is the ambient temperature. This error can be estimated with the aid of equations, (2.3) and (2.4).

For Diode Noise Sources:

$$F = 10 \log \left(\text{antilog} \ (Fm/10) - (T/T_o - 1) \right) \qquad (2.3)$$

For Gas Tube Sources (argon):

$$F = 10 \log \left(\text{antilog} \ (Fm/10) - (T/T_o - 1) \times \left(1 + (1/33.1) \ \text{antilog} \ (Fm/10) \right) \right) \qquad (2.4)$$



Dämpning med röret tänt (Transmissionsdämpn.).
Hot loss

Fig. 2.7

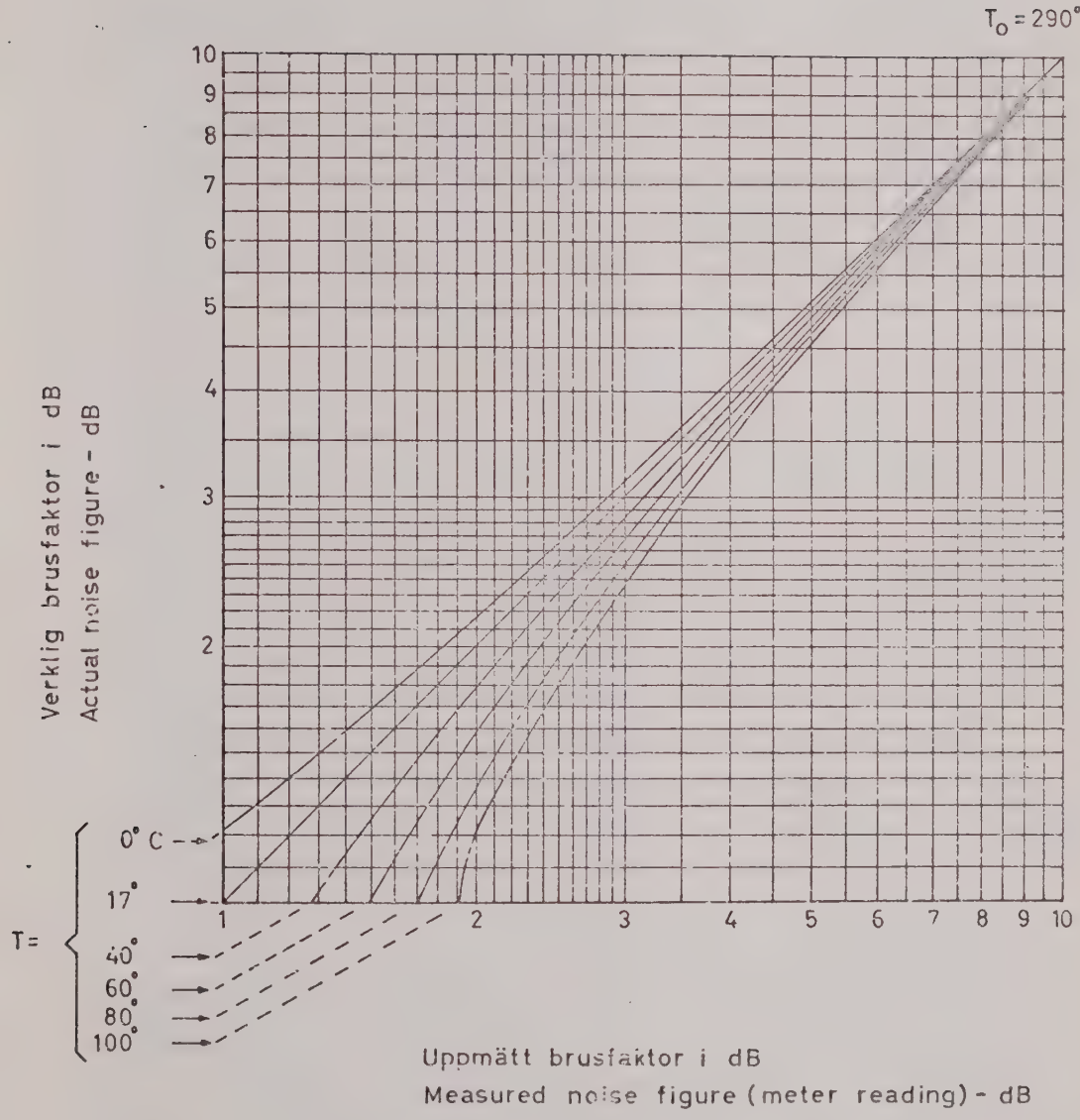
where F = actual noise figure
Fm = indicated noise figure
T = ambient temperature in deg. Kelvin
T_o = 290°K
33.1 = excess noise ratio (15.2 dB)

Eq. (2.3) is shown in fig 2.8. Eq. (2.4) gives about the same values as eq. (2.3) so the same curve (fig 2.8) can be used for this equation.

The mismatch errors are of a complicated nature as they depend on the mismatches of the receiver and the noise source and the distance between these mismatches. For a noise source VSWR of 1.2 and a receiver VSWR of 2 a maximum error of ± 0.4 dB can exist.

Spurious Responses

Noise Figure Meter Model 117A is calibrated for a receiver with no image response. Should the receiver have the same sensitivity for the image as for the signal, the indicated noise figure will be 3 dB too low. This is not a fault in the instrument as it is due to the fact that the noise source is generating noise on both frequencies.



TEMPERATUR - KORREKTION FÖR BRUSKÄLLA MED TEMPERATURBEGRÄNSAD DIOD

TEMPERATURE CORRECTION FOR DIODE NOISE SOURCE.

Fig. 2.8

3. PRINCIPLES OF OPERATION

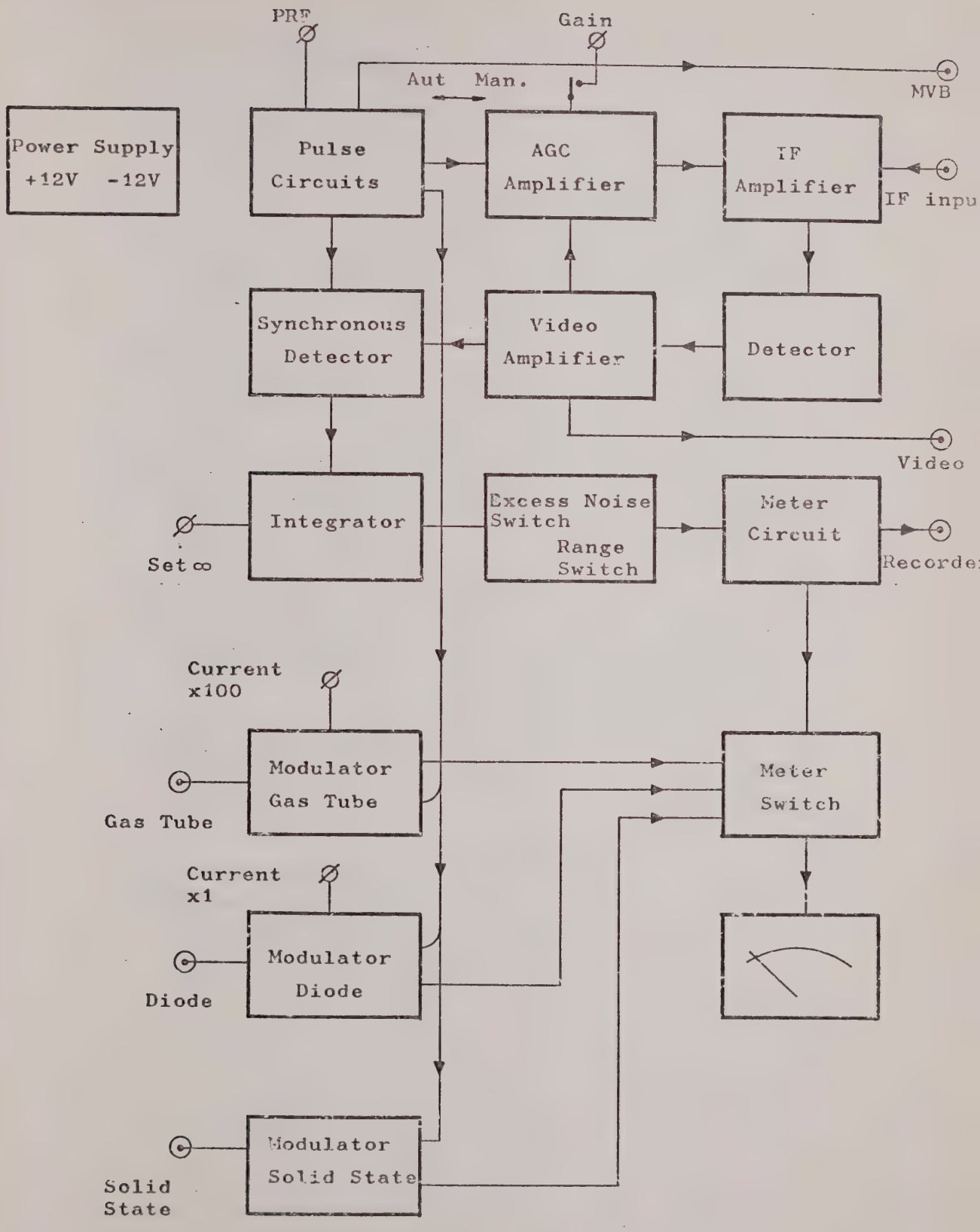
To make noise figure measurements, the model 117A Noise Figure Meter, the appropriate noise source and the device under test are connected as shown in the block diagram. The Noise Figure Meter square wave modulates the noise source at about a 330 Hz rate and measures noise figure by comparing the noise output of the device under test when the noise source is off, with the noise output when the noise source is on.

The input circuitry of the model 117A consists of a gated tuned amplifier, which operates at frequencies selected by a front panel switch. The output from the amplifier is applied to two integrators which are gated alternately at about 330 Hz, the same rate at which the noise source is turned on and off. When the noise source is off the power from the device under test is amplified by the amplifier and integrated by the AGC integrator. The time constant of the AGC voltage, applied to the amplifier, is long enough to hold the gain of the amplifier the same whether the noise source is on or off.

When the noise source is turned on, the combined noise power from the source and the device under test is amplified by the tuned amplifier, integrated and displayed on the meter. Because of the AGC action, the meter deflection is proportional to the difference of the noise powers (source on and source off) and since the additional noise from the noise source (excess noise) is accurately known, the meter face is calibrated directly in dB of noise figure.

The AGC action, in addition to establishing a reference, provides a wide (50 dB) dynamic range and also eliminates the necessity for periodic resetting. The meter face is provided with one noise figure scale, which can be expanded so that a reading can always be made on the upper half of the meter scale.

Scales are also provided to indicate the current supplied to the noise sources and thus facilitate the initial set-up of the source. A coax jack is provided on the rear to drive a remote meter or recorder, so that a permanent record of noise figure can be made, or so that a plot of noise figure versus frequency can be made of broad band receivers. Although designed for fast, accurate, automatic noise figure measurements, this Noise Figure Meter can also be used for manual measurements. A switch in the instrument converts it to an accurate square law indicator. The noise source may then be switched on or off as desired, the noise ratio noted. From this the noise figure can be calculated.



BLOCK DIAGRAM MODEL 117A

4. LIST OF ILLUSTRATIONS

Noise Figure Meter model 117A
- Wiring Diagram — E-117370

Power Supply
- Circuit Diagram — E-117001
- Component Layout — E-117015

Pulse Unit
- Circuit Diagram — E-117002
- Component Layout — E-117017

AGC and Measurement Unit
- Circuit Diagram — E-117003
- Component Layout — E-117019

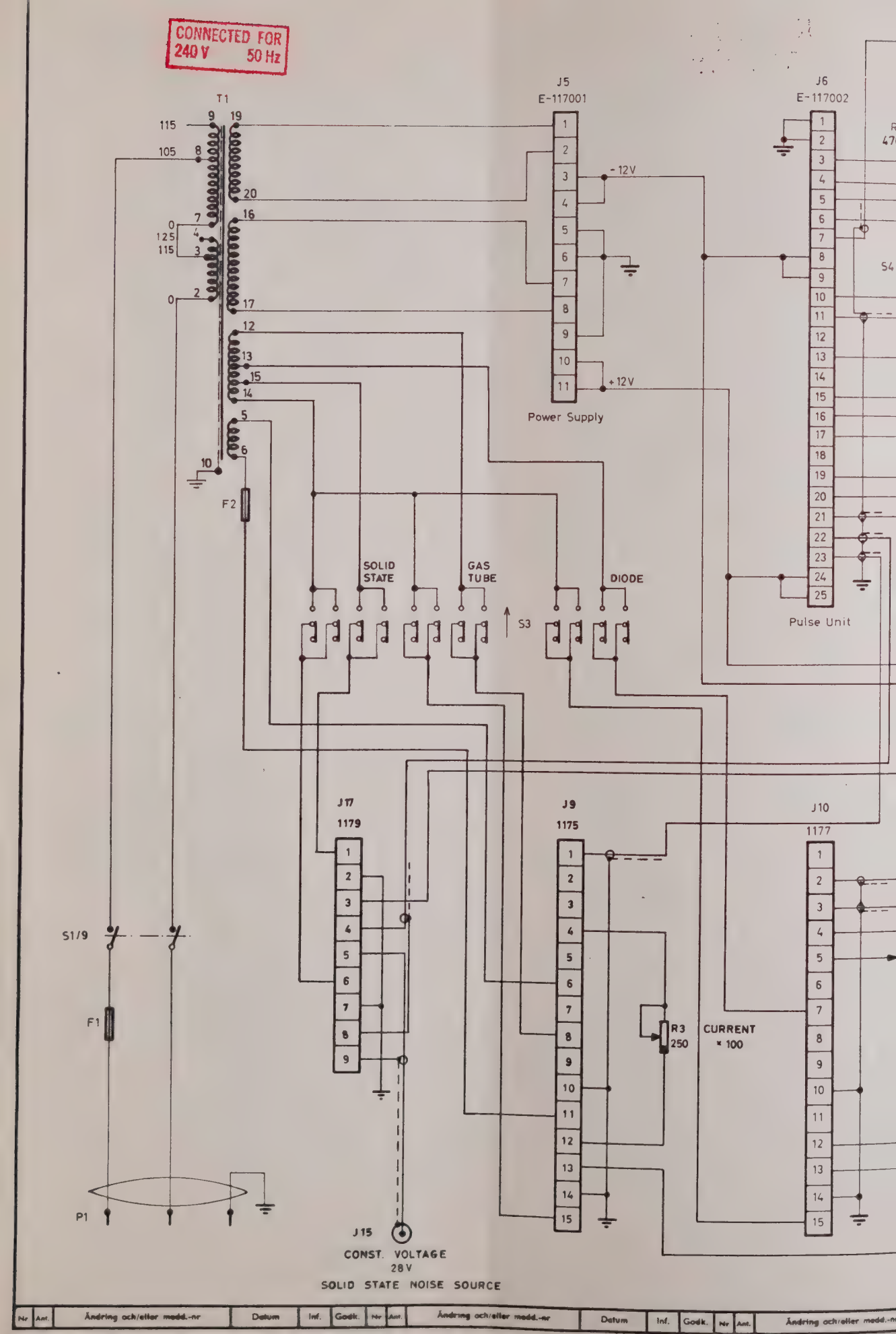
Meter and Switch Unit
- Circuit Diagram — E-117004
- Component Layout — E-117021

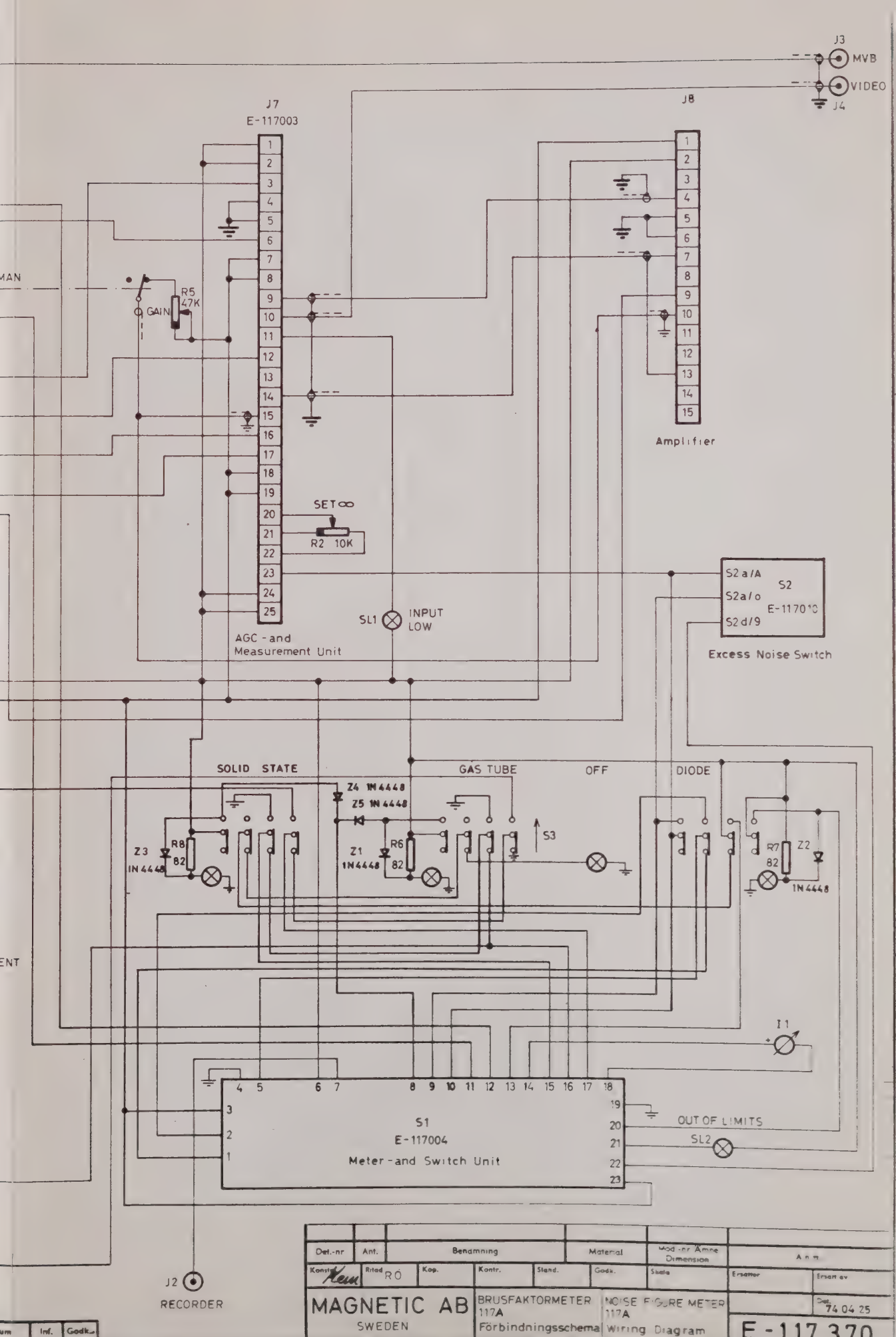
Excess Noise Switch
- Circuit Diagram — E-117010
- Component Layout — E-117103

Modulators model 1175, 1177 and 1179
Amplifiers model 1171 to 1173
- For circuit diagram see separate manuals for these units.

Vi förbehåller oss rätten att utan meddelande ändra, i stycklistor angivna komponenter till motsvarande av annat fabrikat, under förutsättning att angivna komponenter ej kan erhållas från våra underleverantörer.

We reserve the right to change, without notice, the components in the components lists to equivalent parts should listed components not be available from our vendors.


CONNECTED FOR
240 V 50 Hz
T1
115
105
125
115
J5
E-117001
J6
E-117002
- 12V
+ 12V
Power Supply
Pulse Unit
F2
F1
S1/9
S3
SOLID STATE
GAS TUBE
DIODE
J17
1179
J9
1175
J10
1177
R3
250
CURRENT
× 100
J15
CONST. VOLTAGE
28V
SOLID STATE NOISE SOURCE
P1


J3
MVB
VIDEO
J4
J7
E-117003
J8
Amplifier
GAIN
R5
47K
SET∞
R2 10K
SL1
INPUT
LOW
AGC - and
Measurement Unit
S2a/A
S2a/o
S2d/9
S2
E-117010
Excess Noise Switch
SOLID STATE
GAS TUBE
OFF
DIODE
Z4 1N4448
Z5 1N4448
Z3
1N4448
R8
82
Z1
1N4448
R6
82
S3
R7
82
Z2
1N4448
I1
S1
E-117004
Meter - and Switch Unit
OUT OF LIMITS
SL2
J2
RECORDER
MAGNETIC AB
SWEDEN
BRUSFAKTORMETER
117A
Förbindningsschema
NOISE FIGURE METER
117A
Wiring Diagram
E-117 370
74 04 25

Pos. Nr Pos. No.	Komponentbeskrivning Description	Värde Value	Effekt Arb.sp. Rating	Tolerans Tolerance	Tillverkare Manufacturer	Typ Nr Part No.
R1	Motstånd, var. Resistor, var.	470 ohm	0.25 W	20%	Lesa	9A1/A
R2	Motstånd, var. Resistor, var.	10 kohm	1.5 W	5%	Reliance	HEL 05-B10 3/4" slotted
R3	Motstånd, var. Resistor, var.	250 ohm	25 W	10%	Ohmite	o154
R4	Motstånd, var. Resistor, var.	1 kohm	1.5 W	5%	Reliance	HEL 05-B10 3/4" slotted
R5	Motstånd, var. Resistor, var.	47 kohm	0.2 W	20%	Lesa	9A1/B
R6	Motstånd Resistor	82 ohm	0.25 W	5%	Vitrohm	100
R7	Motstånd Resistor	82 ohm	0.25 W	5%	Vitrohm	100
R8	Motstånd Resistor	82 ohm	0.25 W	5%	Vitrohm	100
F1	Säkringshållare Fuse Holder				H. Schurter AG	FEP 031.1001
	Säkring Fuse	220V/0.5A 115V/1A	Trög Slow Blow			5x20 mm
F2	Säkringshållare Fuse Holder				H. Schurter AG	FEP 031.1001
	Säkring Fuse	1 A	Trög Slow Blow			5x20 mm

Pos. Nr Pos. No.	Komponentbeskrivning Description	Värde Value	Effekt Arb. sp. Rating	Tolerans Tolerance	Tillverkare Manufacturer	Typ Nr Part No.
I1	Instrument Meter				Magnetic AB	E-117009
J2	Kontakt, BNC Connector, BNC					UG-1094/U
J3	Kontakt, BNC Connector, BNC					UG-1094/U
J4	Kontakt, BNC Connector, BNC					UG-1094/U
J5	Kontakt, 11 pol. Connector, 11 ways				ITT	12-302-021
	Kortkontakthållare Socket Support				ITT	13-094-007
	Styrskena med stopp Guide insert, locking type	1 st 1 pc			ITT	34-018-111
	Styrskena utan stopp Guide insert, non-locking type	1 st 1 pc			ITT	14-018-111
	Skruv Screw	2 st 2 pcs			ITT	24-009-007
	Låsstift Fixing strip	2 st 2 pcs			ITT	14-005-001
J6	Kontakt, 25 pol. Connector, 25 ways				ITT	12-301-021
	Detaljer i övrigt, se J5 Other details, see J5					

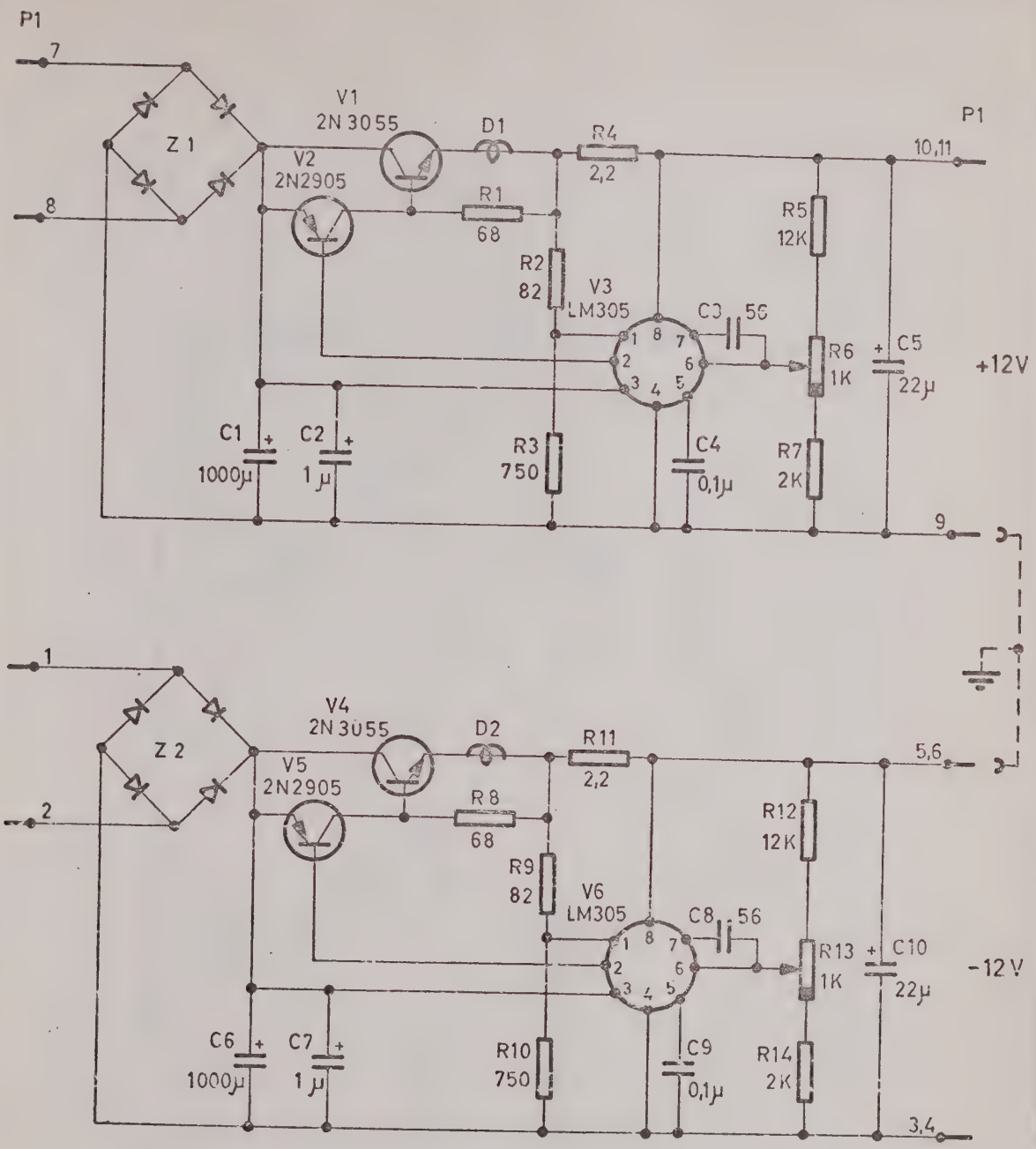
Pos. Nr Pos. No.	Komponentbeskrivning Description	Värde Value	Effekt Arb.sp. Rating	Tolerans Tolerance	Tillverkare Manufacturer	Typ Nr Part No.
J7	Kontakt, 25 pol. Connector, 25 ways				ITT	12-301-021
	Detaljer i övrigt, se J5 Other details, see J5					
J8	Kontakt, 15 pol. Connector, 15 ways				Amphenol	17-90150-16
J9	Kontakt, 15 pol. Connector. 15 ways				Amphenol	17-80150-16
J10	Kontakt, 15 pol. Connector, 15 ways				Amphenol	17-80150-16
J15	Kontakt, BNC Connector, BNC					UG-1094/U
J17	Kontakt, 9 pol. Connector, 9 ways				Amphenol	17-80090-16
P1	Nätkontakt Power Line Plug					
S1	Instrument- och omkopplingsenhet Meter- & Switch Unit				Magnetic AB	E-117004
S2	Omkopplare Switch				Magnetic AB	E-117010
S3	Tryckknappsomkopplare Push Buttom Switch				MEC	MXL-4A spec.

Flytande montage
Float Mounted

Pos. Nr Pos. No.	Komponentbeskrivning Description	Värde Value	Effekt Arb. sp. Rating	Tolerans Tolerance	Tillverkare Manufacturer	Typ Nr Part No.
	Lampa 4 st Lamp 4 pcs	12 V 50 mA	T5.5		Taunuslicht	
S4	Strömbrytare Switch				APR	519T Luxe
SL1	Lamphållare Lamp holder				Olten	01-040
	Lins Lens				Olten	01-901.2
	Lampa Lamp	12 V 50 mA	T5.5		Taunuslicht	
SL2	Lamphållare Lamp holder				Olten	01-040
	Lins Lens				Olten	01-901.2
	Lampa Lamp	50 mA	12 V	T5.5	Taunuslicht	
T1	Transformator Transformer				Lintron AB	2621

Pos. Nr Pos. No.	Komponentbeskrivning Description	Värde Value	Effekt Arb. sp. Rating	Tolerans Tolerance	Tillverkare Manufacturer	Typ Nr Part No.
Z1	Diod Diode					1N4448
Z2	Diod Diode					1N4448
Z3	Diod Diode					1N4448
Z4	Diod Diode					1N4448
Z5	Diod Diode					1N4448
	Ratt till R1 o. R5	2 st.			Elma	021-232
	Täcklock till d:o	2 st.			Elma	040-102
	Ratt till R3 o. R4	2 st.			Elma	020-352
	Täcklock till d:o	2 st.			Elma	040-302
	Muttertäckning till d:o	2 st.			Elma	044-302

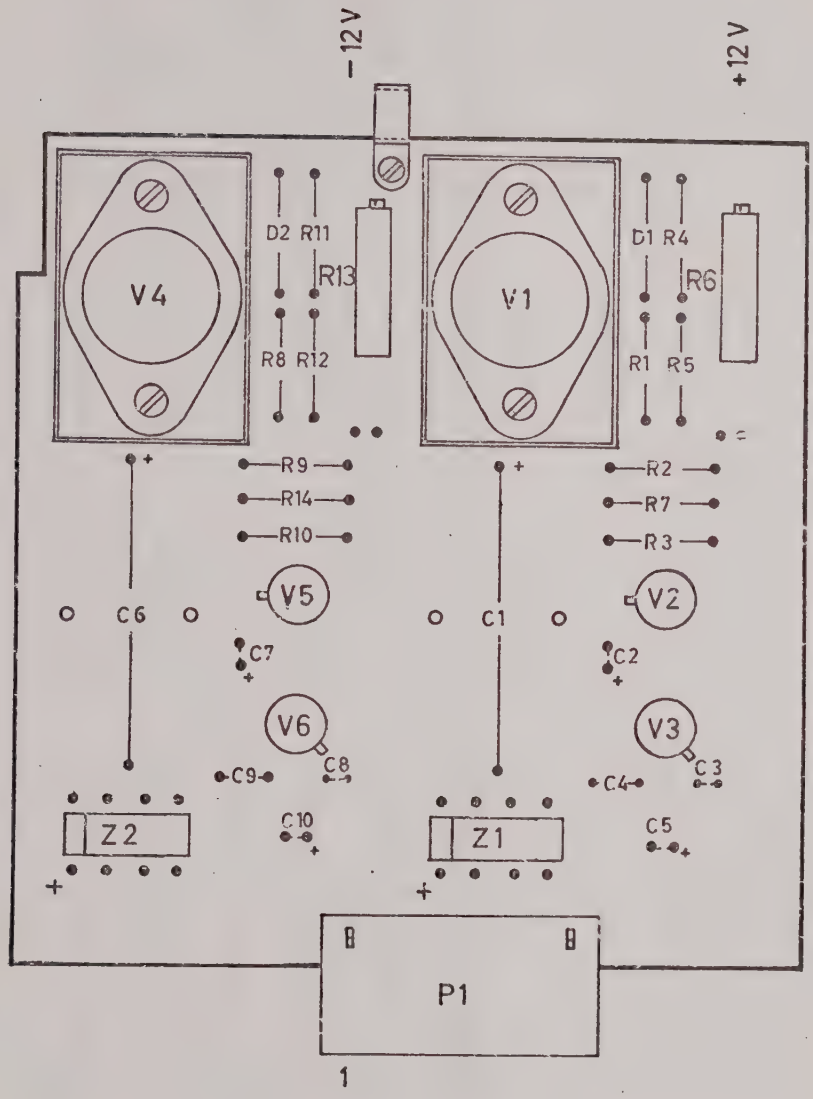
DENNA RITNING FÖRBLIVER VÅR EGENDOM, ATT UTAN VÅRT MEDGIVANDE MÅNGFALDIGA, FÖREVISA, UTLÄMNA ELLER ELJEST OBEHÖRIGEN ANVÄNDA DENSAMMA ÄR FÖRBJUDET OCH BEIVRAS MED STÖD AV LAG AV DEN 30 MAJ 1919 SAMT LAG AV DEN 29 MAJ 1931 § 3.



A 19.5.71 CG	KOMPONENTPLACERING / COMPONENT LAYOUT						E-117015		
Det.-nr	Art.	Benämning			Material		Anm.		
Konstr.	Ritad R.Ö.	Kop.	Konstr	Stand.	Godk.	Skala	Ersatter	Ersatt av	
MAGNETIC AB Stockholm Sweden		LIKRIKTARE E-117001 Principschema		POWER SUPPLY E-117001 Circuit Diagram			Blad	Dat. 23.1.70	
							Ritn.-nr E-117001		

1223 Wilkenssons ... Stockholm

DENNA RITNING FÖRBLIVER VÅR EGENDOM, ATT UTAN VÅRT MEDGIVANDE MÅNGFALDIGA, FÖREVISA, UTLÄMNA ELLER ELJEST OBEHÖRIGEN ANVÄNDA DENSAMMA ÄR FÖRBJUDET OCH BEIVRAS MED STÖD AV LAG AV DEN 30 MAJ 1919 SAMT LAG AV DEN 29 MAJ 1931 § 3.



C1 och C6 bindes fast.
V1 och V4 monteras med kylfläns E-7231 och Distans E-211131
D1 och D2 fixeras med K.K. eller dyligt.

A 19,5,71 CG								Principschema E-117001	
								Håltritning E-117016	
Det.-nr	Ant.	Benämning			Material			Anm.	
Konstr.	Ritad CG	Kop.	Konstr.	Stånd.	Godk.	Skala		Ersatter	Ersatt av
MAGNETIC AB Stockholm Sweden		LIKRIKTARE E-117001 Komponentplacering			POWER SUPPLY E-117001 Component Layout			Ritad	Dat. 10.12.69
								Ritn.-nr E-117015	

Pos. Nr Pos. No.	Komponentbeskrivning Description	Värde Value	Effekt Arb. sp. Rating	Tolerans Tolerance	Tillverkare Manufacturer	Typ Nr Part No.
R1	Motstånd Resistor	68 ohm	0,5 W	5%	Vitrohm	104
R2	Motstånd Resistor	82 ohm	0,5 W	5 %	Vitrohm	104
R3	Motstånd Resistor	750 ohm	0,5 W	5 %	Vitrohm	104
R4	Motstånd Resistor	2,2 ohm	6 W	10 %	Painton	5101
R5	Motstånd Resistor	12 kohm	0,125 W	1 %	Vitrohm	410-0 T2
R6	Motstånd, var Resistor	1 kohm	0,5 W		Burns (Helipot)	3009 P (79P,89P)
R7	Motstånd Resistor	2 kohm	0,125 W	1 %	Vitrohm	410-9 T2
R8	Motstånd Resistor	68 ohm	0,5 W	5 %	Vitrohm	104
R9	Motstånd Resistor	82 ohm	0,5 W	5 %	Vitrohm	104
R10	Motstånd Resistor	750 ohm	0,5 W	5 %	Vitrohm	104
R11	Motstånd Resistor	2,2 ohm	6 W	10 %	Painton	5101
R12	Motstånd Resistor	12 kohm	0,125 W	1 %	Vitrohm	410-0 T2
R13	Motstånd, var Resistor	1 kohm	0,5 W		Bourns (Helipot)	3009P (79P,89P)
R14	Motstånd Resistor	2 kohm	0,125 W	1 %	Vitrohm	410-0 T2

E-117001 1(3)

Pos. Nr Pos. No.	Komponentbeskrivning Description	Värde Value	Effekt Arb.sp. Rating	Tolerans Tolerance	Tillverkare Manufacturer	Typ Nr Part No.
C1	Kondensator, elyt Capacitor, elyt	1000 uF	25 V		Rifa	PEG 118 HG 410
C2	Kondensator, tantal Capacitor, tantalum	1 uF	35 V		ITT	TAG 1/35
C3	Kondensator, ker Capacitor, cer	56 pF	100 V	2 %	Philips	2222 632 10569
C4	Kondensator, ker Capacitor, cer	0,1 uF	30 V		Erie	811/T/30V
C5	Kondensator, tantal Capacitor, tantalum	22 uF	16 V		ITT	TAG 22/16
C6	Kondensator, elyt Capacitor, elyt	1000 uF	25 V		Rifa	PEG 118 HG 410
C7	Kondensator, tantal Capacitor, tantalum	1 uF	35 V		ITT	TAG 1/35
C8	Kondensator, ker Capacitor, cer	56 pF	100 V		Philips	2222 632 10569
C9	Kondensator, ker Capacitor, cer	0,1 uF	30 V		Erie	811/T/30V
C10	Kondensator, tantal Capacitor, tantalum	22 uF	30 V		ITT	TAG 22/16
D1	Drossel Choke	4 st i serie 4 beads in serie			Philips	4322 020 34400
D2	Drossel Choke	4 st i serie 4 st beads in serie			Philips	4322 020 34400
P1	Kontakt, 11 pol Connector, 11 ways				ITT	12-212-001

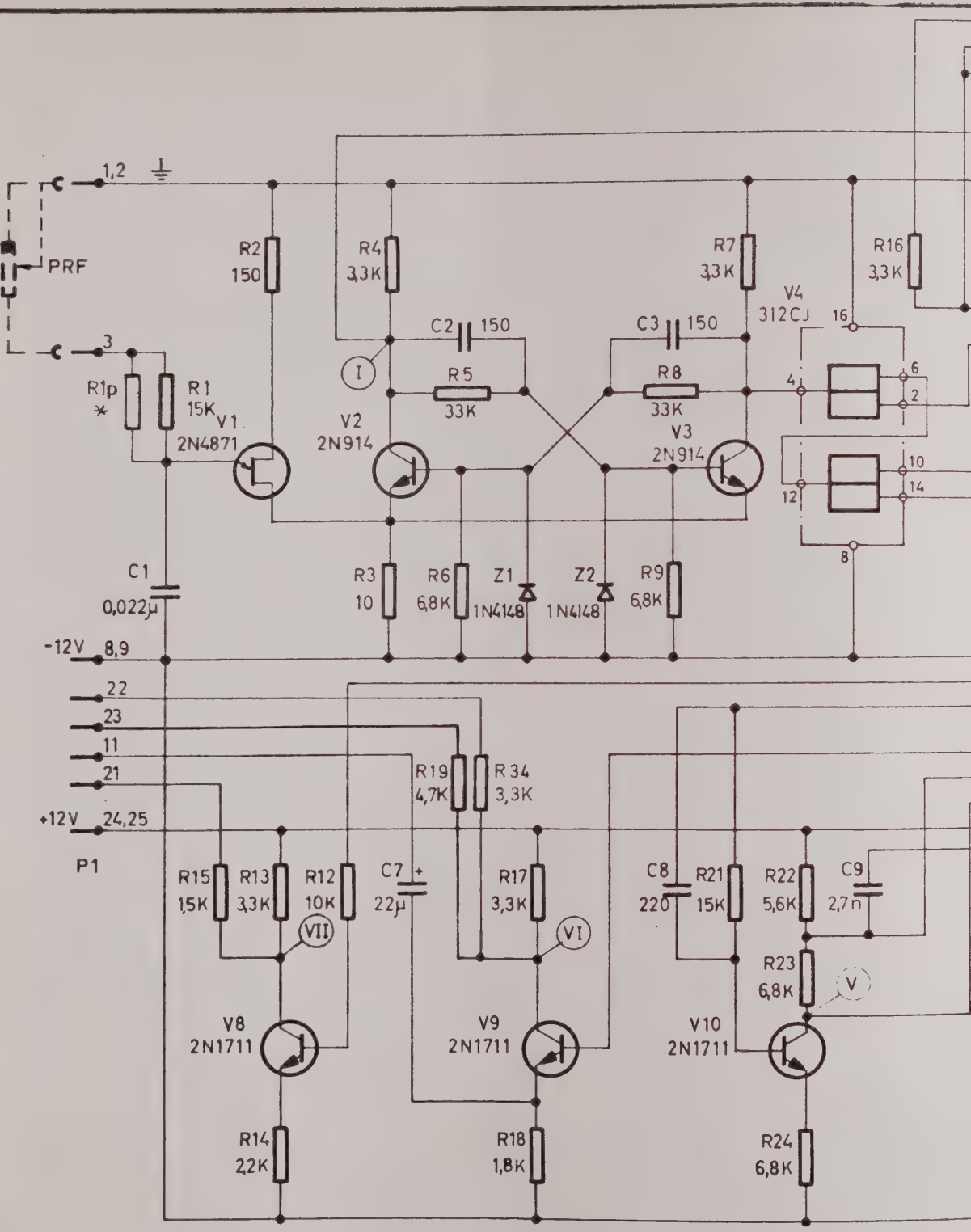
E-117001 2(3)

Pos. Nr Pos. No.	Komponentbeskrivning Description	Värde Value	Effekt Arb. sp. Rating	Tolerans Tolerance	Tillverkare Manufacturer	Typ Nr Part No.
	Mellanlägg Spacer				ITT	14-007-021
	Nit Rivet	2 st			ITT	14-014-002
V1	Transistor					2N 3055
V2	Transistor					2N 2905
V3	Integrerad krets IC					LM 305
V4	Transistor					2N 3055
V5	Transistor					2N 2905
V6	Integrerad krets IC					LM 305
Z1	Likriktare, brygga Rectifier, bridge				Philips (Varo)	BY 164 (VS 148)
Z2	Likriktare, brygga Rectifier, bridge				Philips (Varo)	BY 164 (VS 148)
	2 st kylfläns				Magnetic AB	E-7231
	4 st distans				Magnetic AB	E-211131
	1 st kabelklammer				Insuloid	NX2
	2 st underlägg f.TO5	(V2 o.V5)			Jermyn	TO5-001 eller liknande
	2 st underlägg	(V30. V6			Jermyn	MON-8LF eller liknande
	2 st Panditklammer	(C1 o. C6)				

E-117001

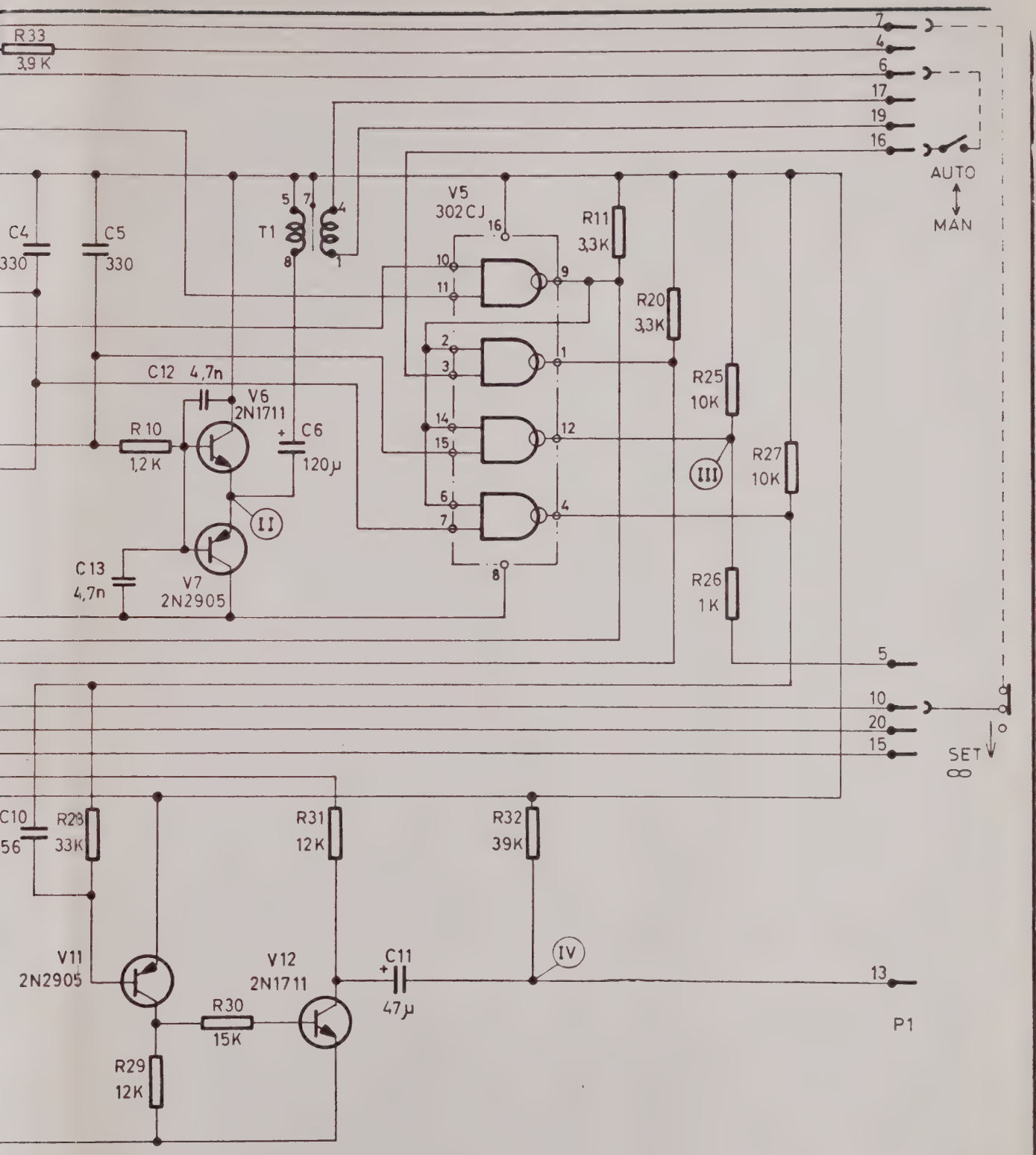
3(3)

DENNA RITNING FÖRBLIVER VÅR EGENDOM, ATT UTAN VÅRT MEDGIVANDE MÅNGFALDIGA, FÖREVISA, UTLÄMNA ELLER ELLEST OBEHÖRIGEN ANVÄNDA DENSAMMA ÄR FÖRBJUDET OCH BEIVRAS MED STÖD AV LAG AV DEN 30 MAJ 1919 SAMT LAG AV DEN 29 MAJ 1931 § 3.



* Justeras vid fabrik
Adjusted at factory

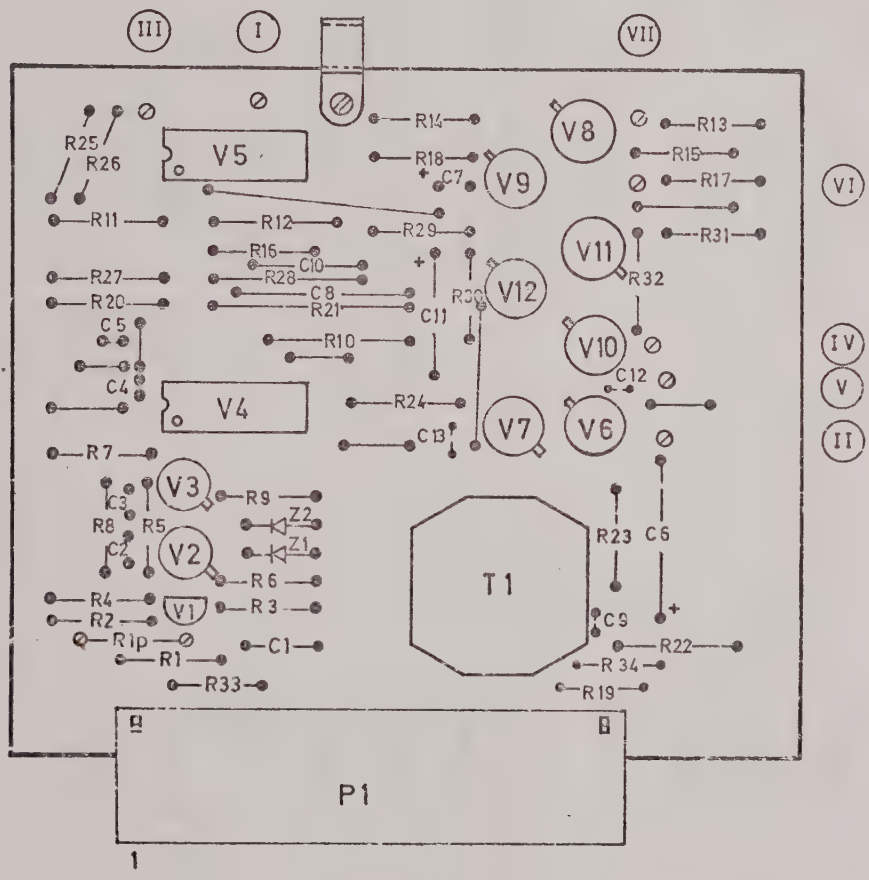
E	760906 JON
D	25574 JON
C	30173
B	24571 CG
A	7 10 70



KOMPONENTPLACERING
COMPONENT LAYOUT | E-117017

Det. nr	Ant.	Benämning	Material	Anm.
Konstr. Hess	Ritad R O	Kap.	Kontr.	Stand.	Godk.	Skala	Ersätter	Ersatt av
MAGNETIC AB Stockholm Sweden	117 PULSENHET Principschema	117 PULSE UNIT Circuit Diagram	Blad	Dat. nr 4 2 70
			Ritn.-nr E-117002	

DENNA RITNING FÖRBLIVER VÅR EGENDOM, ATT UTAN VÅRT MEDGIVANDE MÅNGFALDIGA, FÖREVISA, UTLÄMNA ELLER ELJEST OSEHÖRIGEN ANVÄNDA DENSAMMA ÄR FÖRBJUDET OCH BEIVRAS MED STÖD AV LAG AV DEN 30 MAJ 1919 SAMT LAG AV DEN 29 MAJ 1931 § 3.



⊘: Lödnit

C8 och C10 isoleras

C 760906 JON								Principschema E-117002		
B 25.5.74 JON								Håltritning	E-117018	
A 24.5.71 C G	Det.-nr	Ant.	Benämning		Material			Anm.		
	Konstr.	Ritad C G	Kop.	Kontr.	Stand.	Godk.	Skala	Ersätter	Ersatt av	
	MAGNETIC AB Stockholm Sweden		117 PULSENHET Komponentplacering		117 PULSE UNIT Component Layout			Ritad	Datum 12.12.1969	
								Ritn.-nr	E-117017	

1223 Wikersons T. AB Stkm

Pos. Nr Pos. No.	Komponentbeskrivning Description	Värde Value	Effekt Arb. sp. Rating	Tolerans Tolerance	Tillverkare Manufacturer	Typ Nr Part No.
R1	Motstånd Resistor	15 kohm	0,25 W	5 %	Vitrohm	100
R2	Motstånd Resistor	150 ohm	0,25 W	5 %	Vitrohm	100
R3	Motstånd Resistor	10 ohm	0,25 W	5 %	Vitrohm	100
R4	Motstånd Resistor	3,3 kohm	0,25 W	5 %	Vitrohm	100
R5	Motstånd Resistor	33 kohm	0,25 W	5 %	Vitrohm	100
R6	Motstånd Resistor	6,8 kohm	0,25 W	5 %	Vitrohm	100
R7	Motstånd Resistor	3,3 kohm	0,25 W	5 %	Vitrohm	100
R8	Motstånd Resistor	33 kohm	0,25 W	5 %	Vitrohm	100
R9	Motstånd Resistor	6,8 kohm	0,25 W	5 %	Vitrohm	100
R10	Motstånd Resistor	1,2 kohm	0,5 W	5 %	Vitrohm	104
R11	Motstånd Resistor	3,3 kohm	0,5 W	5 %	Vitrohm	104
R12	Motstånd Resistor	10 kohm	0,5 W	5 %	Vitrohm	104
R13	Motstånd Resistor	3,3 kohm	0,5 W	5 %	Vitrohm	104
R14	Motstånd Resistor	2,2 kohm	0,5 W	5 %	Vitrohm	104
R15	Motstånd Resistor	1,5 kohm	0,5 W	5 %	Vitrohm	104

Pos. Nr Pos. No.	Komponentbeskrivning Description	Värde Value	Effekt Arb. sp. Rating	Tolerans Tolerance	Tillverkare Manufacturer	Typ Nr Part No.
R16	Motstånd Resistor	3,3 kohm	0,25 W	5 %	Vitrohm	100
R17	Motstånd Resistor	3,3 kohm	0,5 W	5 %	Vitrohm	104
R18	Motstånd Resistor	1,8 kohm	0,5 W	5 %	Vitrohm	104
R19	Motstånd Resistor	4,7 kohm	0,25 W	5 %	Vitrohm	100
R20	Motstånd Resistor	3,3 kohm	0,5 W	5 %	Vitrohm	104
R21	Motstånd Resistor	15 kohm	0,25 W	5 %	Vitrohm	100
R22	Motstånd Resistor	5,6 kohm	0,5 W	5 %	Vitrohm	104
R23	Motstånd Resistor	6,8 kohm	0,5 W	5 %	Vitrohm	104
R24	Motstånd Resistor	6,8 kohm	0,5 W	5 %	Vitrohm	104
R25	Motstånd Resistor	10 kohm	0,5 W	5 %	Vitrohm	104
R26	Motstånd Resistor	1 kohm	0,5 W	5 %	Vitrohm	104
R27	Motstånd Resitor	10 kohm	0,5 W	5 %	Vitrohm	104
R28	Motstånd Resistor	33 kohm	0,25 W	5 %	Vitrohm	100
R 29	Motstånd Resistor	12 kohm	0,5 W	5 %	Vitrohm	104
R30	Motstånd Resistor	15 kohm	0,25 W	5 %	Vitrohm	100

Pos. Nr Pos. No.	Komponentbeskrivning Description	Värde Value	Effekt Arb.sp. Rating	Tolerans Tolerance	Tillverkare Manufacturer	Typ Nr Part No.
R31	Motstånd Resistor	12 kohm	0,5 W	5 %	Vitrohm	104
R32	Motstånd Resistor	39 kohm	0,5 W	5 %	Vitrohm	104
R33	Motstånd Resistor	3,9 kohm	0,25 W	5 %	Vitrohm	100
R34	Motstånd Resistor	3,3 kohm	0,25 W	5 %	Vitrohm	100
C1	Kondensator, MP Capacitor, MP	0,022 µF	400 V	10 %	Rifa	PME 2614/0,022
C2	Kondensator, ker Capacitor, cer	150 pF	100 V	2 %	Philips	2222 632 58151
C3	Kondensator, ker Capacitor, cer	150 pF	100 V	2 %	Philips	2222 632 58151
C4	Kondensator, ker Capacitor, cer	330 pF	100 V		Philips	2222 630 02331
C5	Kondensator, ker Capacitor, cer	330 pF	100 V		Philips	2222 630 02331
C6	Kondensator, tantal Capacitor, tantalum	120 µF	10 V	20 %	ITT	472-LWA-402 EA
C7	Kondensator, tantal Capacitor, tantalum	22 µF	16 V	20 %	ITT	TAG 22/16
C8	Kondensator, ker Capacitor, cer	220 pF	100 V	2 %	Philips	2222 632 58221
C9	Kondensator, ker Capacitor, cer	2,7 nF	100 V		Philips	2222 630 02272
C10	Kondensator, ker Capacitor, cer	56 pF	100 V	2 %	Philips	2222 632 10569
C11	Kondensator, elyt Capacitor, elyt	47 µF	16 V		Rifa	PCE 110 47 016

MAGNETIC AB

Pos. Nr Pos. No.	Komponentbeskrivning Description	Värde Value	Effekt Arb. sp. Rating	Tolerans Tolerance	Tillverkare Manufacturer	Typ Nr Part No.
C12	Kondensator, ker Capacitor, cer	4,7 nF	100 V		Philips	2222 630 02472
C13	Kondensator, ker Kapacitor, cer	4,7 nF	100 V		Philips	2222 630 02472
P1	Kontakt, 25 pol Connector, 25 poles				ITT	12-211-001
	Mellanlägg Spacer					14-007-011
	Nit Rivet	2 st				14-014-002
T1	Transformator Transformer				Magnetic AB	E-117007
V1	Transistor				Motorola	2N 4871
V2	Transistor					2N 914
V3	Transistor					2N 914
V4	Integrerad krets IC				Amelco	312 CJ
V5	Integrerad krets IC				Amelco	302 CJ

E-117002 4(5)

Pos. Nr Pos. No.	Komponentbeskrivning Description	Värde Value	Effekt Arb. sp. Rating	Tolerans Tolerance	Tillverkare Manufacturer	Typ Nr Part No.
V6	Transistor					2N 1711
V7	Transistor					2N 2905
V8	Transistor					2N 1711
V9	Transistor					2N 1711
V10	Transistor					2N 1711
V11	Transistor					2N 2905
V12	Transistor					2N 1711
Z1	Diod, Diode					1N 4148
Z2	Diod, Diode					1N 4148
	3 st underlägg f.TO18	(V1-V3)			Jermyn	TO18-002
	7 st underlägg f.TO5	(V6-V12)			Jermyn	TO5-001
	1 st kabelklammer				Insuloid	NX2

DENNA RITNING FÖRBLIVER VÅR EGENDOM, ATT UTAN VÅRT MEDGIVANDE NÄNGFALDIGAS, FÖREVISAS, UTLÄMNAS ELLER ELLER ELIST OBEHÖRIGEN ANVÄNDAS DENSAMMA ÄR FÖRBJUDET OCH BEIVRAS MED STÖD AV LAG AV DEN 30 MAJ 1919 SAMT LAG AV DEN 29 MAJ 1931 § 3.

+12V 1,2
9
10
4,5
-12V 7,8
11
+12V 24,25
14
12
15
17
16
-12V 18,19
P1

R1 47K
R2 3,3K
R3 22K
R4 100K
R5 56K
R6 1K
R7 1K
R8 8,2K
R11 10K
R12 22K
R13 10K
R14 10K
R15 10K
R16 1K
R17 1K
R18 6,8K
R21 10K
C1 10µ
C2 120µ
C3 4.7n
C4 4.7n
C5 22
C7 68µ
C8 4.7n
C9 4.7n
C10 22
Z1 1N4148
Z2 1N4148
D1
D2
D3
D4
V1 2N3824
V2 LM 301 AN
V3 2N3824
V4 LM 301 AN
I
II

R37 1,5K
R34 18K
R31 10K
R32 2,7K
R33 2,2K
R27 1,8K
C15 33µ
C14 220µ
R25 470K
R55 10K
V5 BSV 80
Z4 1N4148
C13 100µ
Z5 1N4148
R22 22K
Z3 1N4148
C12 68µ
Z9 1N4148
V11 2N2905
V10 2N2905
V9 2N2905
V8 2N1711
Z8 1N4148
R29 2,2K
V7 2N1711
Z7 1N4148
V6 2N2905
R26 33K
Z6 1N4148
R24 33K
Z11 1N4148
R56 10K
R23 2,7K
R41 20K
R39 9,1K
R40 *
R38 470
R36 560
C18 1n
R35 560
C17 1n
R30 1,8K
R28 15K
C16 100µ
V
III
IV

R48 10K
R51 180K
R9 34K R10 *
R53 6,8K
R50 1K
R49 10K
C19 10µ
R52 1K
R54 2,5K
C20 33p
V12 LM 301 AN
VI
T2
Z10 BAY78
R42 1K
R43 1K
R44 1K
R45 1K
R46 1K
R47 1K

3
6
21
20
22
23
P1
SET

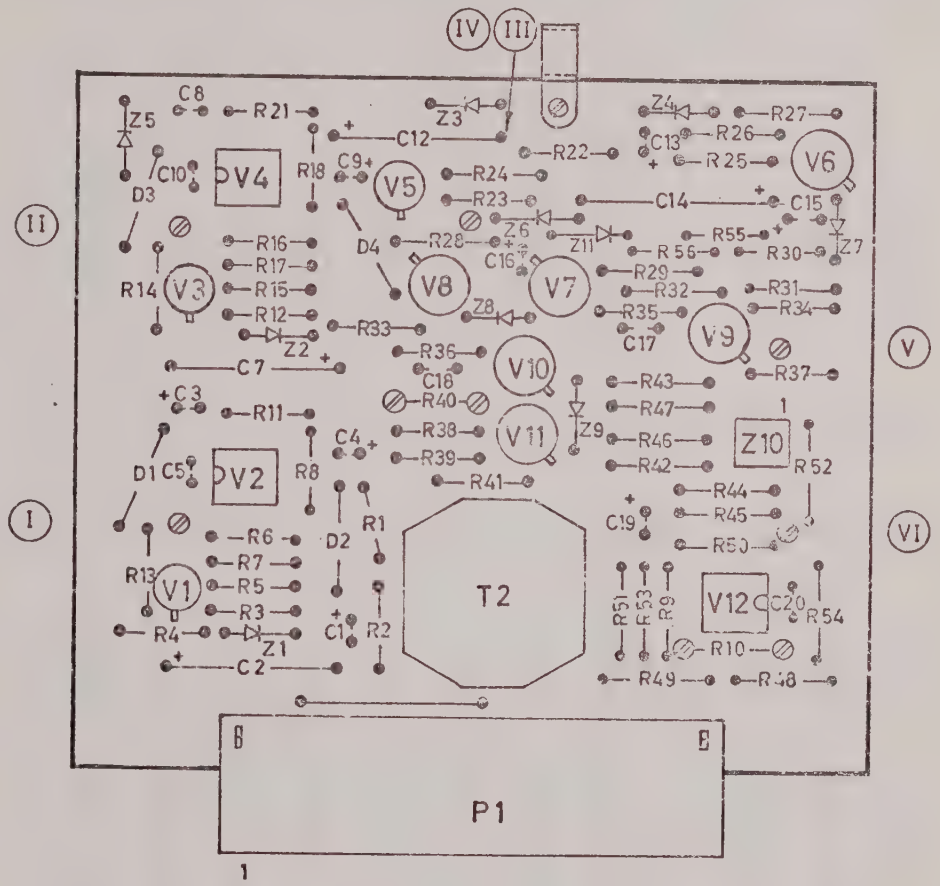
D 25.6.74 JON
C 29.173 ES
B 25.5.71 CG
A 8.10 70

KOMPONENTPLACERING
COMPONENT LAYOUT
E-117019

*UTPROVAS I FABRIK
SELECTED AT FACTORY

Det. nr	Ant.	Benämning	Material	Anm.
Konstr. Hans	Ritad R.Ö.	Kap.	Kontr.	Stand.	Godk.	Skala	Ersatter	Ersatt av
MAGNETIC AB Stockholm Sweden	117 AGC-& MÄTENHET Principschema	117 AGC-and MEASUREMENT UNIT Circuit Diagram	Blad	Dat. nr 5 2 70
			Ritn.-nr E-117003	

DENNA RITNING FÖRBEHÅLLER VI OSS EGENDOM, ATT UTAN VÅRT MEDGIVANDE MÅNGFALDIGA, FÖREVISA, UTLÄMNA ELLER ELJEST OBEHÖRIGEN ANVÄNDA DENSAMMA ÄR FÖRBJUDET OCH BEIVRAS MED STÖD AV LAG AV DEN 29 MAJ 1931 § 3.



⊘ Lödnit

B 25.5.71 JON A 25.5.71 C G									Principschema E-117003 Håltritning E-117020		
Det.-nr	Ant.	Benämning		Material					Anm.		
Konstr.	Kritad C G	Kop.	Konstr.	Stand.	Godk.	Skala			Ersätter	Ersatt av	
MAGNETIC AB Stockholm Sweden		117 AGC & Mätenhet Komponentplacering		117 AGC and Measurement Unit Component Layout					Blad	Dat. 11.12.69	
									Ritn.-nr E-117019		

Pos. Nr Pos. No.	Komponentbeskrivning Description	Värde Value	Effekt Arb. sp. Rating	Tolerans Tolerance	Tillverkare Manufacturer	Typ Nr Part No.
R1	Motstånd Resistor	4,7 kohm	0,25 W	5 %	Vitrohm	100
R2	Motstånd Resistor	3,3 kohm	0,25 W	5 %	Vitrohm	100
R3	Motstånd Resistor	22 kohm	0,25 W	5 %	Vitrohm	100
R4	Motstånd Resistor	100 kohm	0,25 W	5 %	Vitrohm	100
R5	Motstånd Resistor	56 kohm	0,25 W	5 %	Vitrohm	100
R6	Motstånd Resistor	1 kohm	0,125 W	1 %	Vitrohm	410-0 T2
R7	Motstånd Resistor	1 kohm	0,125 W	1 %	Vitrohm	410-0 T2
R8	Motstånd Resistor	8,2 kohm	0,125 W	1 %	Vitrohm	410-0 T2
R9	Motstånd Resistor	34 kohm	0,125 W	1 %	Vitrohm	410-0 T2
R10	Motstånd Resistor		0,25 W	5 %	Vitrohm	100
R11	Motstånd Resistor	10 kohm	0,25 W	5 %	Vitrohm	100
R12	Motstånd Resistor	22 kohm	0,25 W	5 %	Vitrohm	100
R13	Motstånd Resistor	10 kohm	0,25 W	5 %	Vitrohm	100
R14	Motstånd Resistor	10 kohm	0,25 W	5 %	Vitrohm	100
R15	Motstånd Resistor	10 kohm	0,25 W	5 %	Vitrohm	100

Pos. Nr Pos. No.	Komponentbeskrivning Description	Värde Value	Effekt Arb.sp. Rating	Tolerans Tolerance	Tillverkare Manufacturer	Typ Nr Part No.
R16	Motstånd Resistor	1 kohm	0,125 W	1 %	Vitrohm	410-0 T2
R17	Motstånd Resistor	1 kohm	0,125 W	1 %	Vitrohm	410-0 T2
R18	Motstånd Resistor	6,8 kohm	0,125 W	1 %	Vitrohm	410-0 T2
R19	Motstånd Resistor					
R20	Motstånd Resistor					
R21	Motstånd Resistor	10 kohm	0,25 W	5 %	Vitrohm	100
R22	Motstånd Resistor	22 kohm	0,25 W	5 %	Vitrohm	100
R23	Motstånd Resistor	2,7 kohm	0,25 W	5 %	Vitrohm	100
R24	Motstånd Resistor	33 kohm	0,125 W	1 %	Vitrohm	410-0 T0
R25	Motstånd Resistor	470 kohm	0,125 W	1 %	Vitrohm	410-0 T0
R26	Motstånd Resistor	33 kohm	0,25 W	5 %	Vitrohm	100
R27	Motstånd Resistor	1,8 kohm	0,125 W	1 %	Vitrohm	410-0 T2
R28	Motstånd Resistor	15 kohm	0,125 W	1 %	Vitrohm	410-0T0
R29	Motstånd Resistor	2,2 kohm	0,25 W	5 %	Vitrohm	100
R30	Motstånd Resistor	1,8 kohm	0,125 W	1 %	Vitrohm	410-0 T2

E-117003 2 (7)

Pos. Nr Pos. No.	Komponentbeskrivning Description	Värde Value	Effekt Arb. sp. Rating	Tolerans Tolerance	Tillverkare Manufacturer	Typ Nr Part No.
R31	Motstånd Resistor	10 kohm	0,25 W	5 %	Vitrohm	100
R32	Motstånd Resistor	2,7 kohm	0,25 W	5 %	Vitrohm	100
R33	Motstånd Resistor	2,2 kohm	0,25 W	5 %	Vitrohm	100
R34	Motstånd Resistor	18 kohm	0,25 W	5 %	Vitrohm	100
R35	Motstånd Resistor	560 ohm	0,25 W	5 %	Vitrohm	100
R36	Motstånd Resistor	560 ohm	0,25 W	5 %	Vitrohm	100
R37	Motstånd Resistor	1,5 kohm	0,25 W	5 %	Vitrohm	100
R38	Motstånd Resistor	470 ohm	0,25 W	5 %	Vitrohm	100
R39	Motstånd Resistor	9,1 kohm	0,125 W	1 %	Vitrohm	410-0 T0
R40	Motstånd Resistor		0,25 W	5 %	Vitrohm	100
R41	Motstånd Resistor	20 kohm	0,125 W	1 %	Vitrohm	410-0 T0
R42	Motstånd Resistor	1 kohm	0,125 W	0,25 %	Vitrohm	400-0 T2
R43	Motstånd Resistor	1 kohm	0,125 W	0,25 %	Vitrohm	400-0 T2
R44	Motstånd Resistor	1 kohm	0,125 W	0,25 %	Vitrohm	400-0 T2
R45	Motstånd Resistor	1 kohm	0,125 W	0,25 %	Vitrohm	400-0 T2

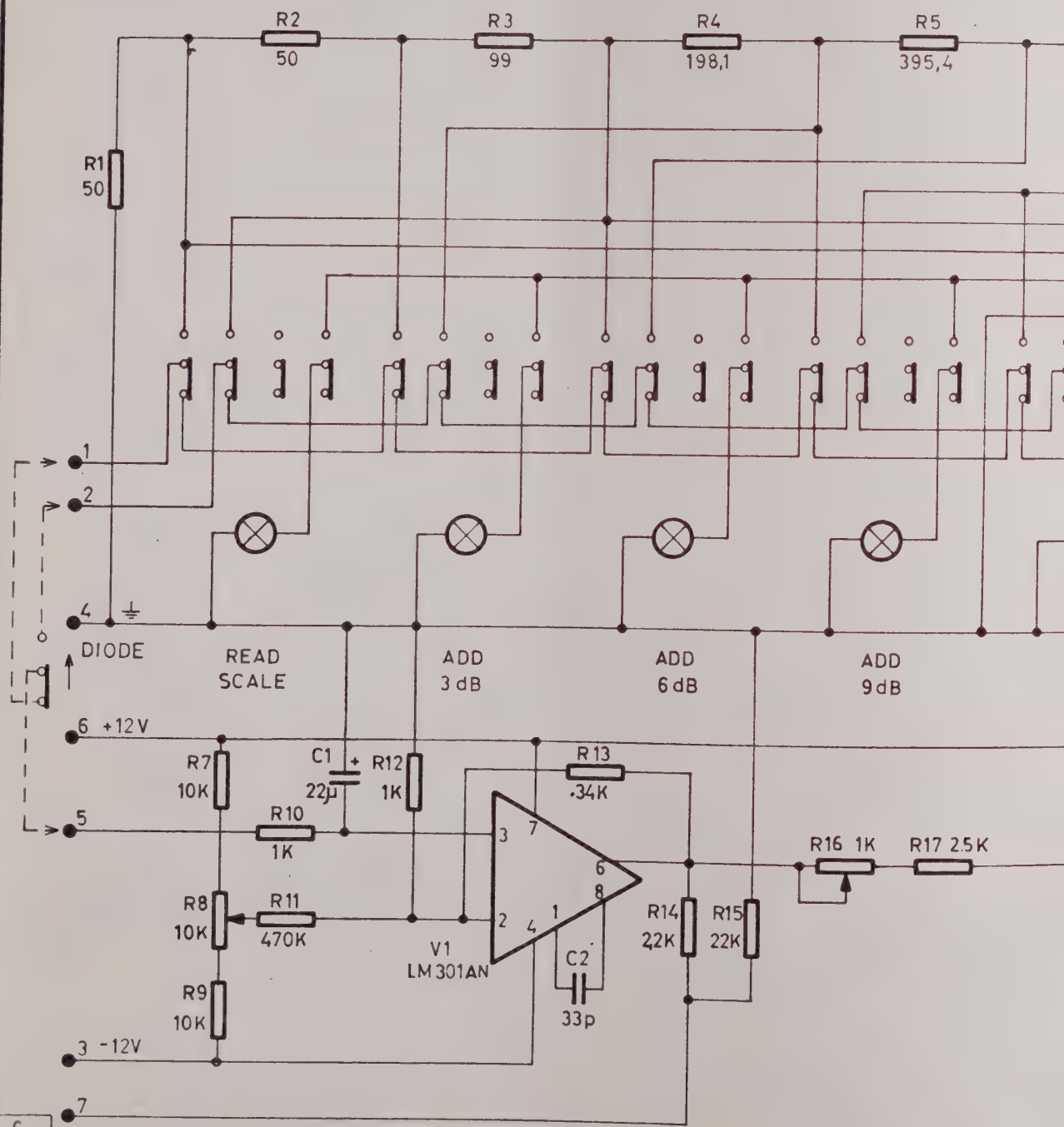
Pos. Nr Pos. No.	Komponentbeskrivning Description	Värde Value	Effekt Arb. sp. Rating	Tolerans Tolerance	Tillverkare Manufacturer	Typ Nr Part No.
R46	Motstånd Resistor	1 kohm	0,125 W	0,25 %	Vitrohm	400-0 T2
R47	Motstånd Resistor	1 kohm	0,125 W	0,25 %	Vitrohm	400-0 T2
R48	Motstånd Resistor	10 kohm	0,125 W	1 %	Vitrohm	410-0 T2
R49	Motstånd Resistor	10 kohm	0,125 W	1 %	Vitrohm	410-0 T2
R50	Motstånd Resistor	1 kohm	0,125 W	1 %	Vitrohm	410-0 T2
R51	Motstånd Resistor	180 kohm	0,125 W	1 %	Vitrohm	410-0 T0
R52	Motstånd Resistor	1 kohm	0,125 W	1 %	Vitrohm	410-0 T2
R53	Motstånd Resistor	6,8 kohm	0,125 W	1 %	Vitrohm	410-0 T2
R54	Motstånd	2,5 kohm	0,125 W	1 %	Vitrohm	410-0 T2
R55	Motstånd	10 kohm	0,25 W	5%	Vitrohm	100
R56	Motstånd	10 kohm	0,25 W	5%	Vitrohm	100
C1	Kondensator, tantal Capacitor, tantalum	10 uF	16 V	20 %	ITT	TAG 10/16
C2	Kondensator, tantal Capacitor, tantalum	120 uF	10 V	20 %	ITT	472-LWA-402EA
C3	Kondensator, ker Capacitor, cer	4,7 nF	100 V		Philips	2222 630 02472
C4	Kondensator, ker Capacitor , cer	4,7 nF	100 V		Philips	2222 630 02472
C5	Kondensator, ker	22 nF	100 V			

Pos. Nr Pos. No.	Komponentbeskrivning Description	Värde Value	Effekt Arb. sp. Rating	Tolerans Tolerance	Tillverkare Manufacturer	Typ Nr Part No.
C6	Kondensator Capacitor					
C7	Kondensator Capacitor	68 µF	15 V	20 %	ITT	472-LWA-402 FA
C8	Kondensator Capacitor	4,7 nF	100 V		Philips	2222 630 02472
C9	Kondensator Capacitor	4,7 nF	100 V		Philips	2222 630 02472
C10	Kondensator, ker Capacitor, cer	22 pF	100 V	2 %	Philips	2222 632 10229
C11	Kondensator ,ker Capacitor,cer					
C12	Kondensator, tantal Capacitor, tantalum	68 µF	15 V	20 %	ITT	472-LWA-402 FA
C13	Kondensator, tantal Capacitor, tantalum	100 µF	3 V	20 %	ITT	TAG 100/3
C14	Kondensator, tantal Capacitor, tantalum	220 µF	10 V	20 %	ITT	472-LWA-403 EA
C15	Kondensator, tantal Capacitor, tantalum	33 µF	10 V	20 %	ITT	TAG 33/10
C16	Kondensator, tantal Capacitor, tantalum	100 µF	3 V	20 %	ITT	TAG 100/3
C17	Kondensator, ker Capacitor, cer	1 nF	100 V		Philips	2222 630 02102
C18	Kondensator, ker Capacitor, cer	1 nF	100 V		Philips	2222 630 02102
C19	Kondensator,tantal Capacitor, tantalum	10 µF	16 V	20 %	ITT	TAG 10/16
C20	Kondensator Capacitor, cer	33 pF	100 V	2 %	Philips	2222 632 10339

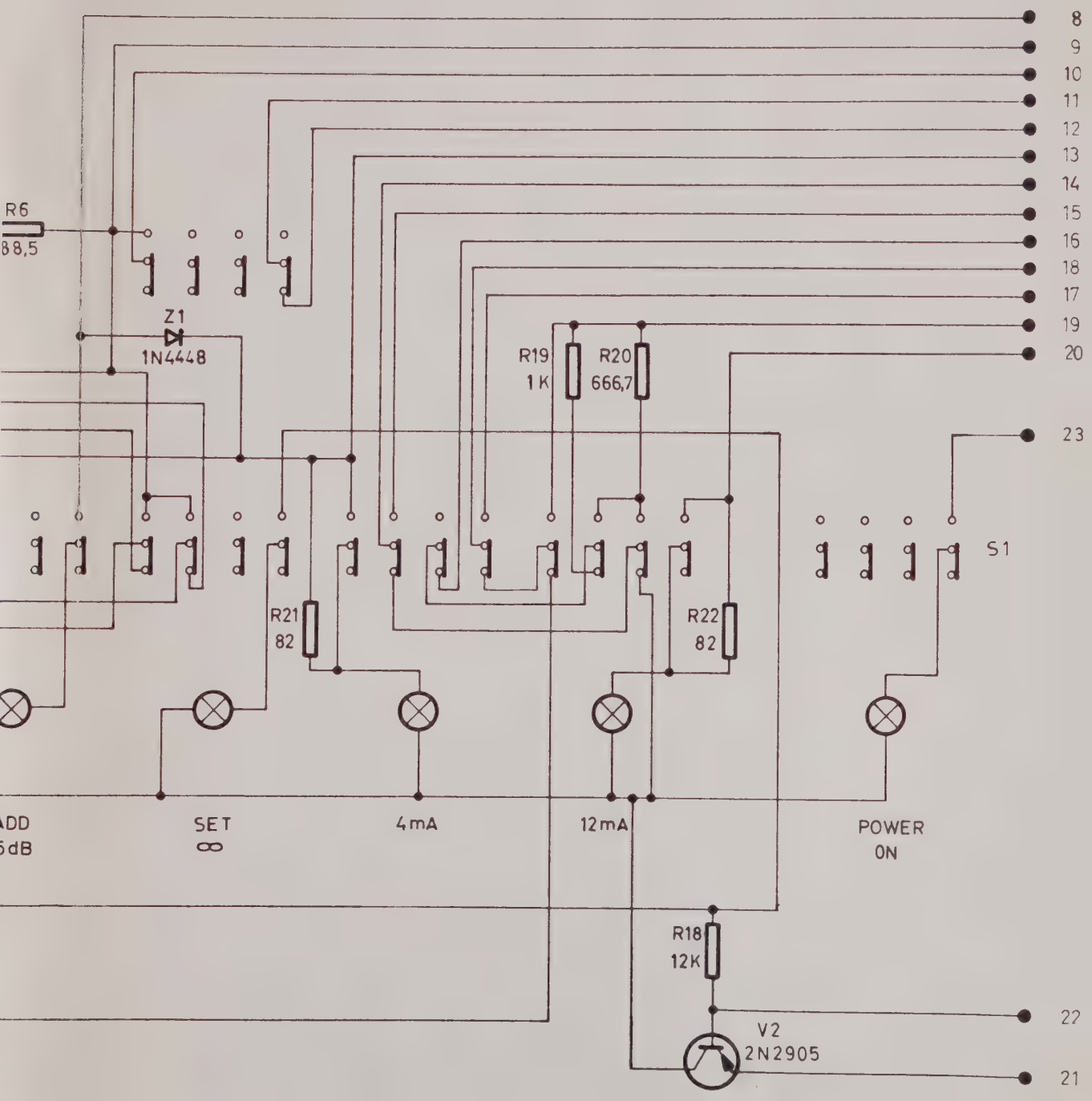
Pos. Nr Pos. No.	Komponentbeskrivning Description	Värde Value	Effekt Arb. sp. Rating	Tolerans Tolerance	Tillverkare Manufacturer	Typ Nr Part No.
D1	Drossel Choke	2 st i serie 2 beads in series			Philips	4322 020 34400
D2	Drossel Choke	2 st i serie 2 beads in series			Philips	4322 020 34400
D3	Drossel	2 st i serie 2 beads in series			Philips	4322 020 34400
D4	Drossel Choke	2 st i serie 2 beads in series			Philips	4322 020 34400
P1	Kontakt, 25 pol Connector, 25 ways				ITT	12-211-001
	Mellanlägg Spacer					14-007-011
	Nit Rivet	2 st 2 pcs				14-014-002
T2	Transformator Transformer				Magnetic AB	E-117008
V1	Transistor, FET					2N 3824
V2	Integrerad krets IC					LM 301 AN
V3	Transistor, FET					2N 3824
V4	Integrerad krets IC					LM 301 AN
V5	Transistor, FET				Philips	BSV 80
V6	Transistor,					2N 2905
V7	Transistor,					2N 1711

Pos. Nr Pos. No.	Komponentbeskrivning Description	Värde Value	Effekt Arb. sp. Rating	Tolerans Tolerance	Tillverkare Manufacturer	Typ Nr Part No.
V8	Transistor					2N 1711
V9	Transistor					2N 2905
V10	Transistor					2N 2905
V11	Transistor					2N 2905
V12	Integrerad krets IC					LM 301 AN
Z1	Diod Diode					1N 4148
Z2	Diod Diode					1N 4148
Z3	Diod Diode					1N 4148
Z4	Diod Diode					1N 4148
Z5	Diod Diode					1N 4148
Z6	Diod Diode					1N 4148
Z7	Diod Diode					1N 4148
Z8	Diode Diode					1N 4148
Z9	Diod Diode					1N 4148
Z10	Diod, kvartett Diode, Quad				Telefunken	BAY 78
Z11	Diod					1N4148
	Kabelklammer				Insuloid	Nx2
	3 st underlägg f.TO18	(V1,V3,V5)			Jermyn	TO18-002
	6 st underlägg f.TO5	(V6-V11)			Jermyn	TO5-001

DENNA RITNING FÖRBLIVER VÅR EGENDOM, ATT UTAN VÅRT MEDGIVANDE MÅNGFALDIGA, FÖREVISA, UTLÄMNA ELLER ELLEST OBEHÖRIGEN ANVÄNDA DENSAMMA ÄR FÖRBJUDET OCH SKRIVAS MED STÖD AV LAG AV DEN 30 MAJ 1919 SAMT LAG AV DEN 29 MAJ 1931 § 3.



C	1.2.73 ES
B	19.5.71 CG
A	9.10.70



KOMPONENT PLACERING
COMPONENT LAYOUT | E-117021

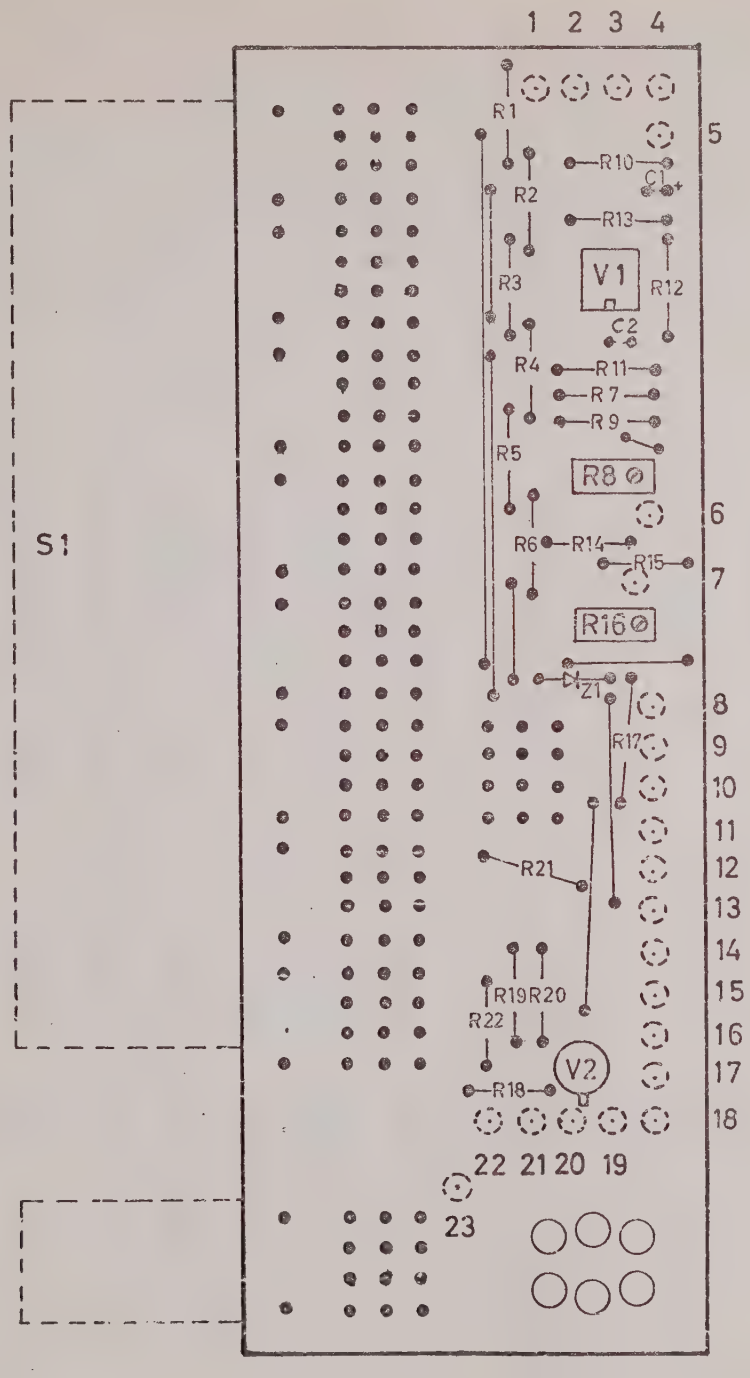
Det. nr	Ant.	Benämning	Material	Anm.

Konstr.	Ritad	Kap.	Kontr.	Stand.	Godk.	Skala	Ersätter	Ersatt av
	R.O.							

MAGNETIC AB	117	117	Blad	Dat. nr

DENNA RITNING FÖRBLIVER VÅR EGENDOM, ATT UTAN VÅRT MEDGIVANDE MÅNGFALDIGA, FÖREVISA, UTLÄMNA ELLER ELLEST OBEHÖRIGEN ANVÄNDA DENSAMMA ÄR FÖRBJUDET OCH BEIVRAS MED STÖD AV LAG AV DEN 30 MAJ 1919 SAMT LAG AV DEN 29 MAJ 1931 § 3.

1-23 Lödtorn monterade från lödsidan. (Elfa K1990)



A 19.5.71 CG								Hålritning	E-117022
								Principschema	E-117004
Det.-nr	Ant.	Benämning		Material				Anm.	
Konstr.	Ritad CG	Kon.	Kontr.	Stand.	Godk.	Skala 1:1		Ersätter	Ersatt av
MAGNETIC AB Stockholm Sweden		117 Instrument- & Omkopplingsenhet Komponentplacering		117 Meter- and Switch Unit Component Layout				Blad	Dat. 3.12.69
								Ritn.-nr	E-117021

1223 Wilkenssons

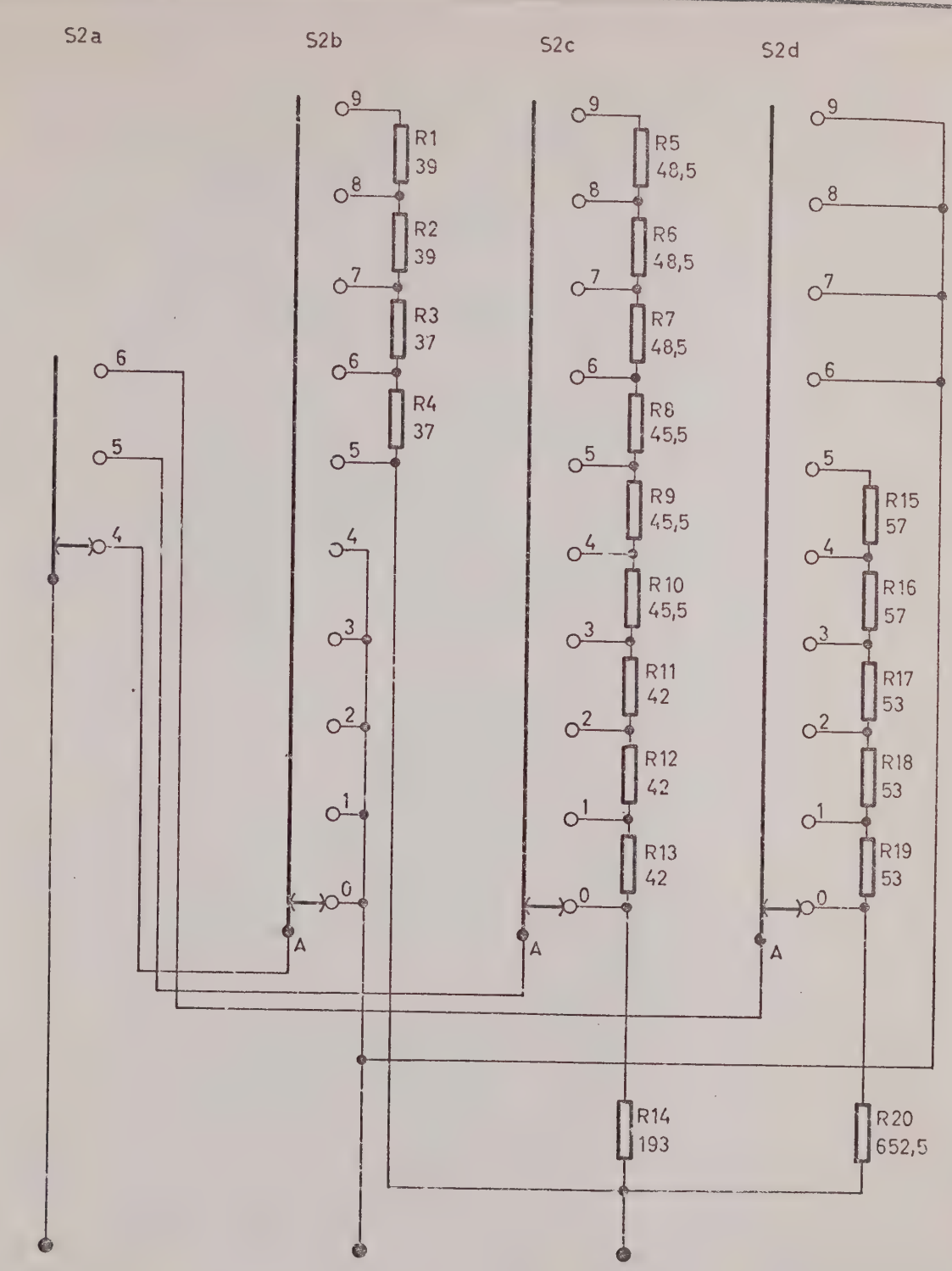
MAGNETIC AB

Pos. Nr Pos. No.	Komponentbeskrivning Description	Värde Value	Effekt Arb. sp. Rating	Tolerans Tolerance	Tillverkare Manufacturer	Typ Nr Part No.
R1	Motstånd Resistor	50 ohm	0.125 W	0,25 %	Vitrohm	400-0 T2
R2	Motstånd Resistor	50 ohm	0,125 W	0,25 %	Vitrohm	400-0 T2
R3	Motstånd Resistor	99 ohm	0,125 W	0,25 %	Vitrohm	400-0 T2
R4	Motstånd Resistor	198,1 ohm	0,125 W	0,25 %	Vitrohm	400-0 T2
R5	Motstånd Resistor	395,4 ohm	0,125 W	0,25 %	Vitrohm	400-0 T2
R6	Motstånd Resistor	788,5 ohm	0,125 W	0,25 %	Vitrohm	400-0 T2
R7	Motstånd Resistor	10 kohm	0,125 W	1 %	Vitrohm	410 -0 T2
R8	Motstånd, var Resistor, var	10 kohm	0,5 W		Helipot	66 W
R9	Motstånd Resistor	10 kohm	0,125 W	1 %	Vitrohm	410-0 T2
R10	Motstånd Resistor	1 kohm	0,125 W	1 %	Vitrohm	410-0 T2
R11	Motstånd Resistor	470 kohm	0,125 W	1 %	Vitrohm	410-0 T0
R12	Motstånd Resistor	1 kohm	0,125 W	1 %	Vitrohm	410-0 T2
R13	Motstånd Resistor	34 kohm	0,125 W	1 %	Vitrohm	410-0 T2
R14	Motstånd Resistor	2,2 kohm	0,25 W	5 %	Vitrohm	100
R15	Motstånd	22 kohm	0,25 W	5 %	Vitrohm	100

E-117004 1(2)

Pos. Nr Pos. No.	Komponentbeskrivning Description	Värde Value	Effekt Arb. sp. Rating	Tolerans Tolerance	Tillverkare Manufacturer	Typ Nr Part No.
R16	Motstånd Resistor	1 kohm	0,5 W		Helipot	66 W
R17	Motstånd Resistor	2,5 kohm	0,125 W	1 %	Vitrohm	410-0 T2
R18	Motstånd Resistor	12 kohm	0,25 W	5 %	Vitrohm	100
R19	Motstånd Resistor	1 kohm	0,125 W	1 %	Vitrohm	410-0 T2
R20	Motstånd Resistor	666,7 ohm	0,125 W	0,5 %	Vitrohm	410-0 T0
R21	Motstånd Resistor	82 ohm	0,25 W	5 %	Vitrohm	100
R22	Motstånd Resistor	82 ohm	0,25 W	5 %	Vitrohm	100
C1	Kondensator, tantal Capacitor, tantalum	22 uF	16 V	20 %	ITT	TAG 22/16
C2	Kondensator, ker Capacitor, cer	33 pF	100 V	2 %	Philips	2222 632 10339
S1	Tryckknappsomkopplare Puch button switch				MEC	MXL-10B spec.
	Lampa 9 st Lamp 9 pcs	12 V 50 mA	T5.5		Taunuslicht	
V1	Integrerad krets IC					LM 301AN
V2	Transistor					2N 2905
Z1	Diod Diode					1N 4448
	1 st underlägg	(V2)			Jermyn	T05-001 eller liknande

DENNA RITNING FÖRBEHÅLLER VÅR EGENDOM, ATT UTAN VÅRT MEDGIVANDE MÅNGFALDIGA, FÖREVISA, UTLÄMNA ELLER FLYTTA OBEHÖRIGEN ANVÄNDA DENSAMMA ÄR FÖRBJUDET OCH BEIVRAS MED STÖD AV LAG AV DEN 30 MAJ 1919 SAMT LAG AV DEN 29 MAJ 1931 § 3.



S2b, S2c och S2d är gangade
S2b, S2c och S2d are ganged

Komponentplacering
Component Layout | E-117103

Del.-nr	Ant.	Benämning	Material	Anm.
Konstr.	Ritad R.Ö.	Kon.	Kontr.	Stand.	Godk.	Skala	Ersatter	Ersatt av

MAGNETIC AB
Stockholm Sweden

117
TILLSKOTTSBRUS-
OMKOPPLARE S2
Principschema

117
EXCESS NOISE
SWITCH S2
Circuit Diagram

Blad | Dat. 10.2.76

Ritn.-nr E-117010

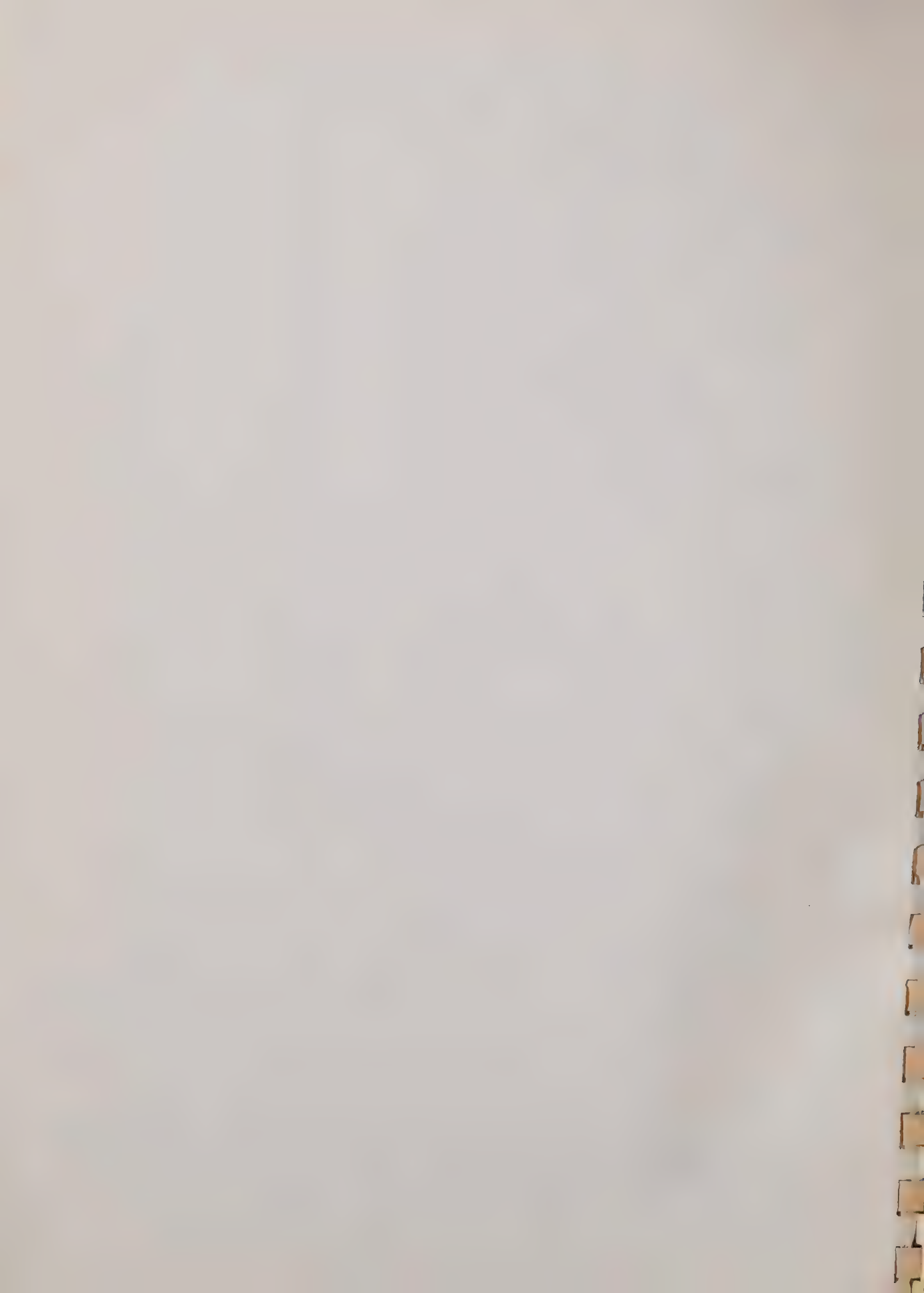
1223 Wilhelmsons T. AB Sthlm

DENNA RITNING FÖRBLIVER VÅR EGENDOM, ATT UTAN VÅRT MEDGIVANDE MÅNGFALDIGA, FÖREVISA, UTLÄMNA ELLER ELJEST OBEHÖRIGEN ANVÄNDA DENSAMMA ÄR FÖRBJUDET OCH BEIVRAS MED STÖD AV LAG AV DEN 30 MAJ 1919 SAMT LAG AV DEN 29 MAJ 1931 § 3.

Längre anslutningstrådar till motstånden isoleras.
Trådlängd: a-b = 60 mm
a-c = 70 mm
a-d = 80 mm
b-d = 70 mm

								Principschema E-117010	
Det.-nr	Ant.	Benämning			Material			Anm.	
Konstr.	Ritad CG	Kap.	Konstr.	Stand.	Godk.	Skala		Ersätter	Ersatt av
MAGNETIC AB Stockholm Sweden			117 Tillskottsbrus-omkopplare S2 Komponentplacering		117 Excess Noise Switch S2 Component Layout			Blad	Dat. 17.2.1970
								Ritn.-nr E-117103	

1223 Wilhelmsons Tr. AB Stkhm



E-117010 Tillskottsbrusomkopplare

Excess Noise Switch S2

MAGNETIC AB

Pos. Nr Pos. No.	Komponentbeskrivning Description	Värde Value	Effekt Arb. sp. Rating	Tolerans Tolerance	Tillverkare Manufacturer	Typ Nr Part No.
R1	Motstånd Resistor	39 ohm	0.125 W	0.5%	Vitrohm	410-0 TO
R2	Motstånd Resistor	39 ohm	0.125 W	0.5%	Vitrohm	410-0 TO
R3	Motstånd Resistor	37 ohm	0.125 W	0.5%	Vitrohm	410-0 TO
R4	Motstånd Resistor	37 ohm	0.125 W	0.5%	Vitrohm	410-0 TO
R5	Motstånd Resistor	48.5 ohm	0.125 W	0.5%	Vitrohm	410-0 TO
R6	Motstånd Resistor	48.5 ohm	0.125 W	0.5%	Vitrohm	410-0 TO
R7	Motstånd Resistor	48.5 ohm	0.125 W	0.5%	Vitrohm	410-0 TO
R8	Motstånd Resistor	45.5 ohm	0.125 W	0.5%	Vitrohm	410-0 TO
R9	Motstånd Resistor	45.5 ohm	0.125 W	0.5%	Vitrohm	410-0 TO
R10	Motstånd Resistor	45.5 ohm	0.125 W	0.5%	Vitrohm	410-0 TO
R11	Motstånd Resistor	42 ohm	0.125 W	0.5%	Vitrohm	410-0 TO
R12	Motstånd Resistor	42 ohm	0.125 W	0.5%	Vitrohm	410-0 TO
R13	Motstånd Resistor	42 ohm	0.125 W	0.5%	Vitrohm	410-0 TO

Pos. Nr Pos. No.	Komponentbeskrivning Description	Värde Value	Effekt Arb. sp. Rating	Tolerans Tolerance	Tillverkare Manufacturer	Typ Nr Part No.
R14	Motstånd Resistor	193 ohm	0.125 W	0.25%	Vitrohm	400-0 T2
R15	Motstånd Resistor	57 ohm	0.125 W	0.5%	Vitrohm	410-0 T0
R16	Motstånd Resistor	57 ohm	0.125 W	0.5%	Vitrohm	410-0 T0
R17	Motstånd Resistor	53 ohm	0.125 W	0.5%	Vitrohm	410-0 T0
R18	Motstånd Resistor	53 ohm	0.125 W	0.5%	Vitrohm	410-0 T0
R19	Motstånd Resistor	53 ohm	0.125 W	0.5%	Vitrohm	410-0 T0
R20	Motstånd	652.5 ohm	0.125 W	0.25%	Vitrohm	400-0 T2
S2	Tumhjulsomkopplare Thumbwheel switch				Magnetic AB	E-117147

ORDERING REPLACEMENT PARTS

When ordering replacement parts, please specify the following information to assure your getting the right part in the shortest possible time.

1. A complete description of the part, e.g. resistance, tolerance, wattage, capacitance, voltage, etc.

2. Instrument model number and serial number.

3. Component designation, e.g. C 34, in parts list or circuit diagram.

Should, for some reason, this information be unknown, please describe the component as accurate as possible; its function and location in the equipment.

The component delivered as a replacement part may not be exactly like the one mounted originally in the equipment, as our purchasing department buys from at least two different vendors. The manufacturer of the original component may also have improved his product and thereby changed the dimensions. However, the component will work in the instrument it is intended for.

Guarantee

Magnetic AB guarantees each equipment and component of its manufacture to be free from defects in material and workmanship for a period of 12 months. Our obligation under this guarantee is limited to servicing or adjusting any instrument returned to our factory for that purpose and to making good at our factory and parts thereof — except tubes, fuses, batteries, semiconductors and bolometers — which shall, within one year after making delivery to the original purchaser, be returned to us with transportation charges prepaid and which, upon examination by us shall appear to have been thus defective, providing misuse or mal-handling can not be proved.

RETURN PROCEDURE:

When returning instruments or components for repair, or for any other reason, please contact the company for shipping instructions. To expedite repair service, it is very important to provide **type number, serial number,** and a **detailed description of the reason for the return of the instrument.**

MP MASTER
MA23372

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